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FRIDAY, OCTOBER 11, 1895.

THE ARCTIC EXPEDITION OF 1895, AND
LIEUTENANT PEARY'S WORK.

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THE North Greenland Expedition of 1895, s. s. Kite, the primary object of which was to bring Lieutenant Peary and his companions back to the United States, left St. Johns, N. F., on the 11th of July. At this time the members of the party were Mr. Emil Diebitsch, Dr. J. E. Walsh, Mr. Theo. Boutilier and the writer. A little later we were joined by Prof. L. L. Dyche, who had preceded us to the coast of Greenland. The chief scientific work undertaken by members of the party was the collection of birds and mammals by Prof. Dyche, and the study of glacial geology by the writer.

After brief stops at Holstenberg, Godhavn, Jakobshavn, Atanikerdluk and Dalrymple Island, Inglefield Gulf, or perhaps more properly Whale Sound, was reached on the morning of the 31st of July. To this point, but little floe-ice had been encountered, even Melville Bay being essentially free from it along the line of our route. In Inglefield Gulf, twenty-five miles or so from Mr. Peary's headquarters, the ice stopped further progress. From the natives who soon boarded the Kite from the settlement of Karnah, it was learned that Mr. Peary had returned from his journey across the inland ice, and that he, together with Messrs. Lee and Henson, was now at the lodge at the head of Bowdoin Bay. After an unsuccessful attempt to reach the

head of the bay by crossing the ice on dog sledges, the lodge was reached on the 3d of August, after an overland journey from the head of McCormick Bay.

The main facts concerning the work of the year were soon learned. The provisions which had been cached on the ice cap for the trip of 1894, not being used that year, were relied upon for the journey of the succeeding season. In September of 1894, after the departure of the *Falcon*, an attempt was made to visit the nearer caches. One of the objects of the visit was to get the provisions out from beneath the season's snow; so as to make them more accessible when the journey of the following spring should be begun. Although the same caches had been visited in the preceding July and the provisions then raised to the surface of the snow, it was found in September that the snowfall of the summer had been so heavy that neither of the two caches nearest the boarder of the ice could be found, the signals having been completely buried. After this discovery, little hope was entertained that search for the caches would be more successful in the following spring. As the caches on the ice contained the pemmican, which was to have been the chief article of food, and the alcohol which was to have served as fuel, Mr. Peary was obliged to face the prospective loss of both. With this unpleasant outlook, the winter was passed.

Instead of giving up the proposed journey across the ice cap, Mr. Peary made such provision for the trip as was possible, and on the 1st of April, accompanied by Lee and Henson, started for Independence Bay. As had been expected, the important caches were not found. In spite of this the crossing of the ice cap was successfully accomplished, the distal edge being reached on the 13th of May. The rest of the month was spent on the land about the bay. From lack of provisions a longer stay was im-

practicable, and the return journey across the ice was begun on the 1st of June and ended on the 25th.

The enterprise and courage with which Mr. Peary conceived and attempted to execute his plans would seem to have entitled him to more consideration at the hands of the powers that be. On two successive years his well matured plans have been thwarted by circumstances over which he had no control, and upon which he could in no way count.

While adverse circumstances have made it impossible for him to carry out, in full, his plans with reference to the north coast of Greenland, he has nevertheless accomplished much during his Arctic residence. He has twice (in 1892 and 1895) crossed the ice cap from Inglefield Gulf to Independence Bay, and has gathered information concerning the inland ice and the ice-free territory beyond, which possesses unique value. Further he has mapped a considerable stretch of the coast of West Greenland, in the vicinity of his headquarters. The full value of this work will first appear when the map is published, but a few general statements concerning it will indicate something of its scope. It covers the coast from Cape Alexander (lat. $78^{\circ} 10'$) on the north to Cape York (lat. $75^{\circ} 55'$) on the south. Within this latitude the range in longitude is nearly 8° . The coast is very irregular, as may be inferred from the fact that its actual length, including the islands near the mainland, is about 1,000 miles. A comparison of Mr. Peary's MS. map with the earlier charts of the same region reveals the extent and the importance of the changes, which are so great as to make it apparent that the new map is really such, and not merely a corrected copy of the old. The modifications are so extensive that, were it not for the names, the new map, and the last edition of the chart of the same region, issued by

the Hydrographic Office, would hardly be taken to represent the same coast. In some places the general trend of the coast is altered many degrees. Many bays are mapped which have not hitherto found representation, and many indentations of the coast which have heretofore appeared upon the charts, have been changed in position and size. Eleven islands which do not appear on the published charts referred to have been accurately located, and the position, shape and size of those heretofore represented have been corrected. A large number of glaciers, probably as many as 100, have been located with approximate accuracy within the region where but ten were represented on the published chart, and even these were in some cases in false positions, and greatly exaggerated in size. Astrup's map of Melville Bay, already published, should be mentioned in this connection, since it was prepared while its author was a member of Mr. Peary's corps. Geographers will not fail to appreciate the magnitude and the importance of this cartographic work.

In addition to the map, Mr. Peary has kept a series of meteorological records, probably the most accurate and elaborate which have ever been secured in so high a latitude. Besides the more formal records, he has been observant of the behavior of winds about the ice sheet, and in this way has come into possession of facts which are not without significance in connection with the problems of glaciology. He has made careful measurements of the rate of motion of one of the most active glaciers of the region, and has carried them through a sufficiently long period of time to give them especial value. He has brought back two large and choice meteorites from the coast east of Cape York, the study of which will possess much popular as well as scientific interest.

In quite another line, important studies

have been prosecuted to a successful issue. During his three years and a half of Arctic residence—adding the time of the earlier visit to that of the later—Mr. Peary has made a study of the Eskimos of North Greenland. During this time he has personally come into contact with almost every man, woman and child on the west coast north of the Danish possessions. He has lived among them in such a way as to get from them data which no temporary visitor could secure, and which no one, not understanding their language, and not commanding their confidence, could hope to gain. As a result, he is in possession of much fuller knowledge of these people than any one else has ever been. The results of his study, when published, will be an important contribution to ethnology.

Indirectly, the expeditions which Mr. Peary has caused to be made into northern waters have not been without result. Five successive voyages, without accident, have shown that Arctic navigation, under proper management, is not so dangerous as has been supposed. Through those who have accompanied these expeditions, much information has been secured touching the natural history, the geography and the geology of the regions visited. Some of these data have been published, while others have not yet appeared, but they must nevertheless be taken into account in enumerating the results of the several expeditions for which Mr. Peary has been responsible. It will be readily seen that the returns are, in the aggregate, very considerable, and that, although the object which was first in mind when the last expedition was planned has not been fully attained, the results which have been achieved cannot be looked upon as incommensurate with the outlay.

So far as concerns the results accomplished by the members of the party of 1895, it may be said that Professor Dyche

was successful in getting large numbers of birds and mammals at various points along the coast. He was especially fortunate in securing an abundant supply of walrus, both bulls and cows, goodly numbers of reindeer and seals, and a smaller number of narwhals.

The writer saw much of the west coast of Greenland between latitude 64° and $78^{\circ} 45'$, at close enough range to study its geographic features to advantage. Stops were made near the parallels of 67° , 69° , 70° , and at many points between $75^{\circ} 45'$ and $77^{\circ} 45'$. At all these points geographical and geological studies were carried on. The eastern coast of America was also seen for a considerable distance, especially from Ellsmere land south to $71^{\circ} 30'$, and most of the coast of the island of Disco. On the Greenland coast many glaciers between $75^{\circ} 45'$ and $77^{\circ} 45'$ were studied in detail, and some determinations of significance concerning glacier motion made. A considerable body of evidence was gathered touching the former extension of the ice cap of Greenland. Determinations were also made at several points concerning recent changes of level of the land.

ROLLIN D. SALISBURY.

UNIVERSITY OF CHICAGO, October 4, 1895.

ON OYSTERS AND TYPHOID.*

OUR motives in undertaking this investigation have been:—

1. Purely scientific—the elucidation of the life conditions of the oyster, both under normal and abnormal environment.

2. Economic or technological—to trace the causes and effects of diseased conditions, with the view of determining what basis

*An experimental inquiry into the effect upon the oyster of various external conditions including pathogenic organisms. A paper presented before Section D. at the Ipswich Meeting of the British Association, by R. W. Boyce, Professor of Pathology in University College, Liverpool; and W. A. Herdman, Professor of Zoölogy in University College, Liverpool,

exists for the recent 'Oyster and typhoid' scare, (a) in the interests of the oyster fisheries, and (b) in the interests of the general public.

A. The objects, in detail, we had in view in entering on the investigation were as follows:—

1. To determine the conditions of life and health and growth of the oyster by keeping samples in sea waters of different composition—*e.g.*, it is a matter of discussion amongst practical ostreiculturists as to what specific gravity or salinity of water, and what amount of lime are best for the due proportionate growth of both shell and body.

2. To determine the effect of feeding oysters on various substances—both natural food, such as Diatoms, and artificial food, such as oatmeal. Here, again, there is a want of agreement at present as to the benefit or otherwise of feeding oysters in captivity.

3. To determine the effect of adding various impurities to the water in which the oysters are grown, and especially the effect of sewage in various quantities. It is notorious that oysters are frequently grown or laid down for fattening purposes in water which is more or less contaminated by sewage, but it is still an open question as to the resulting effect upon the oyster.

4. To determine whether oysters not infected with a pathogenic organism, but grown under insanitary conditions, have a deleterious effect when used as food by animals.

5. To determine the effect upon the oyster of infection with typhoid, both naturally—*i.e.*, by feeding with sewage water containing typhoid stools, and artificially—*i.e.*, by feeding on a culture in broth of the typhoid organism.

6. To determine the fate of the typhoid bacillus in the oyster—whether it is confined to the alimentary canal, and whether it increases in any special part or gives rise

to any diseased conditions; how long it remains in the alimentary canal; whether it remains and grows in the pallial cavity, on the surface of the mantle and branchial folds; and whether it produces any altered condition of these parts that can be recognized by the eye on opening the oyster.

7. To determine whether an oyster can free its alimentary canal and pallial cavity from the typhoid organism when placed in a stream of clean sea water; and, if so, how long would be required, under average conditions, to render infected oysters practically harmless.

B. The methods which we employed in attaining these objects were as follows:—

1. Observations upon oysters laid down in the sea, at Port Erin—

(a) Sunk in 5 fathoms in the bay, in pure water.

(b) Deposited in shore pool, but in clean water.

(c) Laid down in three different spots in more or less close proximity to the main drain pipe, opening into the sea below low-water mark.

These were to ascertain differences of fattening, condition, mortality, and the acquisition of deleterious properties as the result of sewage contamination.

2. Observations upon oysters subjected to various abnormal conditions in the laboratory.*

(a) A series of oysters placed in sea water and allowed to stagnate, in order to determine effect of non-aëration.

(b) Similar series in water kept periodically aërated.

(c) A series placed in sea water to which a given quantity of fresh (tap) water was added daily, to determine effect of reduction of salinity.

* The oysters were kept in basins in cool rooms of constant temperature, shaded from the sun, both at the Port Erin Biological Station and also in the Pathological and Zoölogical Laboratories at University College, Liverpool.

(d) A series of oysters weighed approximately, and fed upon the following substances, viz.:—

(1) Oatmeal.

(2) Flour.

(3) Sugar.

(4) Broth.

(5) Living Protophyta (Diatoms, Desmids, Algæ).

(6) Living Protozoa (Infusoria, etc.).

(7) Earth.

In this series of experiments the oysters were fed every morning and the water aërated, but not changed (evaporation was compensated for by the addition of a little tap water as required). The oysters were weighed from time to time, and observations made upon the apparently harmful or beneficial effects of the above methods of treatment.

(e) A series of oysters placed in sea water to which was added daily—

(1) Healthy faecal matter.

(2) Typhoid faecal matter.

(3) Pure cultivations of the typhoid bacillus.

The oysters were carefully examined to determine their condition, with special reference to condition of branchia, alimentary canal, adductor muscle, and viscera generally. The contents of the rectum, as well as the water in the pallial cavity, were subjected to bacteriological analysis to determine the number of micro-organisms present, as well as the identity of the typhoid or other pathogenic organisms.

C. The following is a summary of the results obtained so far:—

We consider that these results are based upon tentative experiments, and serve only to indicate further any definite lines of research. They must not be regarded as conclusive. We feel strongly that all the experiments must be repeated and extended in several directions.

Our experiments demonstrate:—

I. The beneficial effects of aëration—

(a) By the addition of air only;

(b) By change of water;

pointing to the conclusion that the laying down of oysters in localities where there is a good change of water, by tidal current or otherwise, should be beneficial.

II. The diverse results obtained by feeding upon various substances, amongst which the following may be noted. The exceedingly harmful action of sugar, which caused the oysters to decrease in weight and die; whilst the other substances detailed above enabled them to maintain their weight or increase. The oysters thrive best upon the living Protophyta and Protozoa. Those fed upon oatmeal and flour after a time sickened and eventually died.

III. The deleterious effects of stagnation, owing to the collection of excretory products, growth of micro-organisms, and formation of scums upon the surface of the water.

IV. The toleration of sewage, etc. It was found that oysters could, up to a certain point, render clear sewage-contaminated water, and that they could live for a prolonged period in water rendered completely opaque by the addition of faecal matter; that the faecal matter obtained from cases of typhoid was more inimical than that obtained from healthy subjects; and that there was considerable toleration to peptonised broth.

V. The infection of the oyster by the micro-organisms. The results of the bacteriological examination of the water of the pallial cavity of the oyster, and of the contents of the rectum, showed that in the cases of those laid down in the open water of the bay the colonies present were especially small in number, whilst in those laid down in proximity to the drain pipe the number was enormous (*e. g.*, 17,000 as against 10 in the former case). It was found that more organisms were present in

the pallial cavity than in the rectum. In the case of the oysters grown in water infected with the *Bacillus typhosus*, it was found that there was no apparent increase of the organisms, but that they could be identified in cultures taken from the water of the pallial cavity and rectum fourteen days after infection.

It is found that the typhoid bacillus will not flourish in clean sea water, and our experiments seem to show so far that it decreases in numbers in its passage along the alimentary canal of the oyster. It would seem possible, therefore, that by methods similar to those employed in the 'Bassins de dégorgement' of the French ostreiculturist, where the oysters are carefully subjected to a natural process of cleaning, oysters previously contaminated with sewage could be freed of pathogenic organisms or their products without spoiling the oyster for the market.

It need scarcely be pointed out that if it becomes possible thus to cleanse infected or suspected oysters by a simple mode of treatment which will render them innocuous, a great boon will have been conferred upon both the oyster trade and the oyster-consuming public.

We desire to acknowledge the kind help of Mr. W. I. Beaumont in making some of the observations at Port Erin, and of Mr. Andrew Scott at Liverpool.

ADDRESS OF THE PRESIDENT, SIR DOUGLAS GALTON, BEFORE THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (II.).

THE earliest Reports of the Association which bear on the biological sciences were those relating to botany. In 1831 the controversy was yet unsettled between the advantages of the Linnæan, or Artificial system, as contrasted with the Natural system of classification. Histology, morphology, and physiological botany, even if born, were

in their early infancy. Our records show that von Mohl noted cell division in 1835, the presence of chlorophyll corpuscles in 1837; and he first described protoplasm in 1846.

In 1831 Cuvier, who, during the previous generation had, by the collation of facts followed by careful inductive reasoning, established the plan on which each animal is constructed, was approaching the termination of his long and useful life. He died in 1832; but in 1831 Richard Owen was just commencing his anatomical investigations and his brilliant contributions to paleontology. The impulse which their labors gave to biological science was reflected in numerous reports and communications, by Owen and others throughout the early decades of the British Association, until Darwin propounded a theory of evolution which commanded the general assent of the scientific world. For this theory was not absolutely new. But just as Cuvier had shown that each bone in the fabric of an animal affords a clue to the shape and structure of the animal, so Darwin brought harmony into scattered facts, and led us to perceive that the moulding hand of the Creator may have evolved the complicated structures of the organic world from one or more primeval cells.

Richard Owen did not accept Darwin's theory of evolution, and a large section of the public contested it. I well remember the storm it produced—a storm of praise by my geological colleagues, who accepted the result of investigated facts; a storm of indignation such as that which would have burned Galileo at the stake from those who were not yet prepared to question the old authorities; but they diminished daily. We are, however, as yet only on the threshold of the doctrine of evolution. Does not each fresh investigation, even into the embryonic stage of the simpler forms of life, suggest fresh problems?

The impulse given by Darwin has been fruitful in leading others to consider whether the same principle of evolution may not have governed the moral as well as the material progress of the human race. Mr. Kidd tells us that nature as interpreted by the struggle for life contains no sanction for the moral progress of the individual, and points out that if each of us were allowed by the conditions of life to follow his own inclination the average of each generation would distinctly deteriorate from that of the preceding one; but because the law of life is ceaseless and inevitable struggle and competition, ceaseless and inevitable selection and rejection, the result is necessarily ceaseless and inevitable progress.

Evolution, as Sir William Flower said, is the message which biology has sent to help us on with some of the problems of human life, and Francis Galton urges that man, the foremost outcome of the awful mystery of evolution, should realize that he has the power of shaping the course of future humanity by using his intelligence to discover and expedite the changes which are necessary to adapt circumstances to man, and man to circumstances.

In considering the evolution of the human race, the science of preventive medicine may afford us some indication of the direction in which to seek for social improvement. One of the early steps towards establishing that science upon a secure basis was taken in 1835 by the British Association, who urged upon the Government the necessity of establishing registers of mortality showing the causes of death "on one uniform plan in all parts of the King's dominions, as the only means by which general laws touching the influence of causes of disease and death could be satisfactorily deduced." The general registration of births and deaths was commenced in 1838. But a mere record of death and

its proximate cause is insufficient. Preventive medicine requires a knowledge of the details of the previous conditions of life and of occupation. Moreover, death is not our only or most dangerous enemy, and the main object of preventive medicine is to ward off disease. Disease of body lowers our useful energy. Disease of body or of mind may stamp its curse on succeeding generations.

The anthropometric laboratory affords to the student of anthropology a means of analyzing the causes of weakness, not only in bodily, but also in mental life. Mental actions are indicated by movements and their results. Such signs are capable of record, and modern physiology has shown that bodily movements correspond to action in nerve centers, as surely as the motions of the telegraph indicator express the movements of the operator's hands in the distant office.

Thus there is a relation between a defective *status* in brain power and defects in the proportioning of the body. Defects in physiognomical details, too finely graded to be measured with instruments, may be appreciated with accuracy by the senses of the observer; and the records show that these defects are in a large degree associated with a brain *status* lower than the average in mental power. A report presented by one of your committees shows that about 16 per 1,000 of the elementary school population appear to be so far defective in their bodily or brain condition as to need special training to enable them to undertake the duties of life and to keep them from pauperism or crime. Many of our feeble-minded children, and much disease and vice, are the outcome of inherited proclivities. Francis Galton has shown us that types of criminals which have been bred true to their kind are one of the saddest disfigurements of modern civilization; and he says that few deserve better of their country

than those who determine to lead celibate lives through a reasonable conviction that their issue would probably be less fitted than the generality to play their part as citizens.

These considerations point to the importance of preventing those suffering from transmissible disease, or the criminal or the lunatic, from adding fresh sufferers to the teeming misery in our large towns. And in any case, knowing as we do the influence of environment on the development of individuals, they point to the necessity of removing those who are born with feeble minds or under conditions of moral danger from surrounding deteriorating influences. These are problems which materially affect the progress of the human race, and we may feel sure that, as we gradually approach their solution, we shall more certainly realize that the theory of evolution, which the genius of Darwin impressed on this century, is but the first step on a biological ladder which may possibly eventually lead us to understand how in the drama of creation man has been evolved as the highest work of the Creator.

The sciences of medicine and surgery were largely represented in the earlier meetings of the Association, before the creation of the British Medical Association afforded a field for their more intimate discussion. The close connection between the different branches of science is causing a revival in our proceedings of discussions on some of the highest medical problems, especially those relating to the spread of infectious and epidemic disease. It is interesting to contrast the opinion prevalent at the foundation of the Association with the present position of the question. A report to the Association in 1834, by Professor Henry, on contagion, says: "The notion that contagious emanations are at all connected with the diffusion of animalculæ through the atmosphere is at variance with all that

is known of the diffusion of volatile contagion."

Whilst it had long been known that filthy conditions in air, earth and water fostered fever, cholera and many other forms of disease, and that the disease ceased to spread on the removal of these conditions, yet the reason for their propagation or diminution remained under a veil.

Leeuwenhoek in 1680 described the yeast-cells, but Schwann in 1837 first showed clearly that fermentation was due to the activity of the yeast-cells; and, although vague ideas of fermentation had been current during the past century, he laid the foundation of our exact knowledge of the nature of the action of ferments, both organized and unorganized. It was not until 1860, after the prize of the Academy of Sciences had been awarded to Pasteur for his essay against the theory of spontaneous generation, that his investigations into the action of ferments enabled him to show that the effects of the yeast-cell are indissolubly bound up with the activities of the cell as a living organism, and that certain diseases, at least, are due to the action of ferments in the living being. In 1865 he showed that the disease of silkworms, which was then undermining the silk industry in France, could be successfully combated. His further researches into anthrax, fowl cholera, swine fever, rabies and other diseases proved the theory that those diseases are connected in some way with the introduction of a microbe into the body of an animal; that the virulence of the poison can be diminished by cultivating the microbes in an appropriate manner; and that when the virulence has been thus diminished their inoculation will afford a protection against the disease.

Meanwhile it had often been observed in hospital practice that a patient with a simple-fractured limb was easily cured, whilst a patient with a compound fracture

often died from the wound. Lister was thence led, in 1865, to adopt his antiseptic treatment, by which the wound is protected from hostile microbes. These investigations, followed by the discovery of the existence of a multitude of micro-organisms and the recognition of some of them—such as the bacillus of tubercle and the comma bacillus of cholera—as essential factors of disease, and by the elaboration by Koch and others of methods by which the several organisms might be isolated, cultivated, and their histories studied, have gradually built up the science of bacteriology. Amongst later developments are the discovery of various so-called antitoxins, such as those of diphtheria and tetanus, and the utilization of these for the cure of disease. Lister's treatment formed a landmark in the science of surgery, and enabled our surgeons to perform operations never before dreamed of; whilst later discoveries are tending to place the practice of medicine on a firm scientific basis.

The study of bacteriology has shown us that, although some of these organisms may be the accompaniments of disease, yet we owe it to the operation of others that the refuse caused by the cessation of animal and vegetable life is reconverted into food for fresh generations of plants and animals. These considerations have formed a point of meeting where the biologist, the chemist, the physicist and the statistician unite with the sanitary engineer in the application of the science of preventive medicine.

The early reports to the Association show that the laws of hydrostatics, hydrodynamics and hydraulics necessary to the supply and removal of water through pipes and conduits had long been investigated by the mathematician. But the modern sanitary engineer has been driven by the needs of an increasing population to call in the chemist and the biologist to help him to provide pure water and pure air. The

purification and the utilization of sewage occupied the attention of the British Association as early as 1864, and between 1869 and 1876 a committee of the Association made a series of valuable reports on the subject. It was not till the chemist called to his aid the biologist, and came to the help of the engineer, that a scientific system of sewage purification was evolved.

Dr. Frankland many years ago suggested the intermittent filtration of sewage; and Mr. Baldwin Latham was one of the first engineers to adopt it. But the valuable experiments made in recent years by the State Board of Health in Massachusetts have more clearly explained to us how by this system we may utilize micro-organisms to convert organic impurity in sewage into food fitted for higher forms of life. To effect this we require, in the first place, a filter of any material which affords numerous surfaces or open pores. Secondly, that after a volume of sewage has passed through the filter an interval of time be allowed, in which the air necessary to support the life of the micro-organisms is enabled to enter the pores of the filter. Thus this system is dependent upon oxygen and time. Under such conditions the organisms necessary for purification are sure to establish themselves in the filter before it has been long in use.

In other branches of civil and mechanical engineering the reports in 1831 and 1832 on the state of this science show that the theoretical and practical knowledge of the strength of timber had obtained considerable development. But in 1830, before the introduction of railways, cast iron had been sparingly used in arched bridges for spans of from 160 to 200 feet, and wrought iron had only been applied to large-span iron bridges on the suspension principle, the most notable instance of which was the Menai suspension bridge, by Telford.

The development of the iron industry is

due to the association of the chemist with the engineer. The introduction of the hot blast by Neilson, in 1829, in the manufacture of cast iron had effected a large saving of fuel. But the chemical conditions which affect the strength and other qualities of iron, and its combination with carbon, silicon, phosphorus and other substances had at that time scarcely been investigated. In 1856 Bessemer brought before the British Association at Cheltenham his brilliant discovery for making steel direct from the blast furnace. This discovery, followed by Siemens's regenerative furnace, by Whitworth's compressed steel, and by the use of alloys and by other improvements too numerous to mention here, has revolutionized the conditions under which metals are applied to engineering purposes.

Indeed, few questions are of greater interest, or possess more industrial importance, than those connected with metallic alloys. This is especially true of those alloys which contain the rarer metals; and the extraordinary effects of small quantities of chromium, nickel, tungsten and titanium on certain varieties of steel have exerted profound influence on the manufacture of projectiles and on the construction of our armored ships. Of late years investigations on the properties and structure of alloys have been numerous, and among the more noteworthy researches may be mentioned those of Dewar and Fleming on the distinctive behavior, as regards the thermo-electric powers and electrical resistance, of metals and alloys at the very low temperatures which may be obtained by the use of liquid air.

Professor Roberts-Austen, on the other hand, has carefully studied the behavior of alloys at very high temperatures, and by employing his delicate pyrometer has obtained photographic curves which afford additional evidence as to the existence of allotropic modifications of metals, and which

have materially strengthened the view that alloys are closely analogous to saline solutions. Professor Roberts-Austen has, moreover, shown that the effect of any one constituent of an alloy upon the properties of the principal metal has a direct relation to the atomic volumes, and that it is consequently possible to fortell, in a great measure, the effect of any given combination.

Metallurgical science has brought aluminium into use by cheapening the process of its extraction; and if by means of the wasted forces in our rivers, or possibly of the wind, the extraction be still further cheapened by the aid of electricity, we may not only utilize the metal or its alloys in increasing the spans of our bridges, and in affording strength and lightness in the construction of our ships, but we may hope to obtain a material which may render practicable the dreams of Icarus and of Maxim, and for purposes of rapid transit enable us to navigate the air.

As early as 1820 the steam engine had been applied by Gurney, Hancock and others to road traction. The absurd impediments placed in their way by road trustees, which, indeed, are still enforced, checked any progress. But the question of mechanical traction on ordinary roads was practically shelved in 1830, at the time of the formation of the British Association, when the locomotive engine was combined with a tubular boiler and an iron road on the Liverpool and Manchester Railway. Great, however, as was the advance made by the locomotive engine of Robert Stephenson, these earlier engines were only toys compared with the compound engines of to-day which are used for railways, for ships, or for the manufacture of electricity. Indeed, it may be said that the study of the laws of heat, which have led to the introduction of various forms of motive power, are gradually revolutionizing all our habits of life.

The improvements in the production of

iron, combined with the developed steam engine, have completely altered the conditions of our commercial intercourse on land; whilst the changes caused by the effects of these improvements in shipbuilding and on the ocean carrying trade have been, if anything, still more marked. At the foundation of the Association all ocean ships were built by hand of wood, propelled by sails, and manœuvred by manual labor; the material limited their length, which did not often exceed 100 ft., and the number of English ships of over 500 tons burden was comparatively small. In the modern ships steam power takes the place of manual labor. It rolls the plates of which the ship is constructed, bends them to the required shapes, cuts, drills, and rivets them in their place. It weighs the anchor; it propels the ship in spite of winds or currents; it steers, ventilates and lights the ship when on the ocean. It takes the cargo on board and discharges it on arrival.

The use of iron favors the construction of ships of a large size, of forms which afford small resistance to the water, and with compartments which make the ships practically unsinkable in heavy seas or by collision. Their size, the economy with which they are propelled, and the certainty of their arrival, cheapen the cost of transport. The steam engine, by compressing air, gives us control over the temperature of cool chambers. In these not only fresh meat, but the delicate produce of the Antipodes, is brought across the ocean to our doors without deterioration. Whilst railways have done much to alter the social conditions of each individual nation, the application of iron and steam to our ships is revolutionizing the international commercial conditions of the world; and it is gradually changing the course of our agriculture as well as of our domestic life.

But, great as have been the developments of science in promoting the commerce of the

world, science is asserting its supremacy even to a greater extent in every department of war. And perhaps this application of science affords at a glance, better than almost any other, a convenient illustration of the assistance which the chemical, physical and electrical sciences are affording to the engineer. The reception of warlike stores is not now left to the uncertain judgment of 'practical men,' but is confided to officers who have received a special training in chemical analysis and in the application of physical and electrical science to the tests by which the qualities of explosives, of guns and of projectiles can be ascertained. For instance, take explosives. Till quite recently black and brown powders alone were used—the former as old as civilization, the latter but a small modern improvement adapted to the increased size of guns. But now the whole family of nitro-explosives are rapidly superseding the old powder. These are the direct outcome of chemical knowledge and not of random experiment. The construction of guns is no longer a haphazard operation. In spite of the enormous forces to be controlled and the sudden violence of their action, the researches of the mathematician have enabled the just proportions to be determined with accuracy; the labors of the physicist have revealed the internal conditions of the materials employed and the best means of their favorable employment. The chemist has rendered it clear that even the smallest quantities of certain ingredients are of supreme importance in affecting the tenacity and trustworthiness of the materials. The treatment of steel to adapt it to the vast range of duties it has to perform is thus the outcome of patient research. And the use of the metals—manganese, chromium, nickel, molybdenum—as alloys with iron has resulted in the production of steels possessing varied and extraordinary properties. The steel required to resist the

conjugate stresses developed, lightning fashion, in a gun necessitates qualities that would not be suitable in the projectile which that gun hurls with a velocity of some 2,500 ft. per second against the armored side of a ship.

The armor, again, has to combine extreme superficial hardness with great toughness, and during the last few years these qualities are sought to be attained by the application of the cementation process for adding carbon to one face of the plate and hardening that face alone by rapid refrigeration. The introduction of metal cartridge-cases of complex forms drawn cold out of solid blocks or plate has taxed the ingenuity of the mechanic in the device of machinery and of the metallurgist in producing a metal possessed of the necessary ductility and toughness. The cases have to stand a pressure at the moment of firing of as much as 25 tons to the square inch. There is nothing more wonderful in practical mechanics than the closing of the breech openings of guns, for not only must they be gas-tight at these tremendous pressures, but such that one man by a single continuous movement shall be able to open or close the breech of the largest gun in some ten or 15 seconds. The perfect knowledge of the recoil of guns has enabled the reaction of the discharge to be utilized in compressing air or springs by which guns can be raised from concealed positions in order to deliver their fire, and then made to disappear again for loading, or the same force has been used to run up the guns automatically immediately after firing, or, as in the case of the Maxim gun, to deliver in the same way a continuous stream of bullets at the rate of ten in one second.

In every department concerned in the production of warlike stores electricity is playing a more and more important part. It has enabled the passage of a shot to be followed from its seat in the gun to its

destination. In the gun, by means of electrical contacts arranged in the bore, a time-curve of the passage of the shot can be determined. From this the mathematician constructs the velocity-curve, and from this again the pressures producing the velocity are estimated and used to check the same indications obtained by other means. Electricity and photography have been laid under contribution for obtaining records of the flight of projectiles and the effects of explosions at the moment of their occurrence. Many of you will recollect Mr. Vernon Boys's marvelous photographs showing the progress of the shot driving before it waves of air in its course. The readiness with which electrical energy can be converted into heat or light has been taken advantage of for the firing of guns, which in their turn can, by the same agency, be laid on the object by means of range finders placed at a distance and in advantageous and safe positions; while the electric light is utilized to illumine the sights at night, as well as to search out the objects of attack.

The advances in engineering which have produced the steam engine, the railway, the telegraph, as well as our engines of war, may be said to be the result of commercial enterprise rendered possible only by the advances which have taken place in the several branches of science since 1831. Having regard to the intimate relations which the several sciences bear to each other, it is abundantly clear that much of this progress could not have taken place in the past, nor could further progress take place in the future, without intercommunication between the students of different branches of science. The founders of the British Association based its claims to utility upon the power it afforded for this intercommunication. Mr. Vernon Harcourt (the uncle of your present General Secretary), in the address he delivered in 1832, said: "How feeble is man for any purpose

when he stands alone—how strong when united with other men! It may be true that the greatest philosophical works have been achieved in privacy, but it is no less true that these works would never have been accomplished had the authors not mingled with men of corresponding pursuits, and from the commerce of ideas often gathered germs of apparently isolated discoveries, and without such material aid would seldom have carried their investigations to a valuable conclusion."

I claim for the British Association that it has fulfilled the objects of its founders, that it has had a large share in promoting intercommunication and combination. Our meetings have been successful because they have maintained the true principles of scientific investigation. We have been able to secure the continued presence and concurrence of the master spirits of science. They have been willing to sacrifice their leisure, and to promote the welfare of the Association, because the meetings have afforded them the means of advancing the sciences to which they are attached.

The Association has, moreover, justified the views of its founders in promoting intercourse between the pursuers of science, both at home and abroad, in a manner which is afforded by no other agency. The weekly and sessional reunions of the Royal Society, and the annual *soirées* of other scientific societies, promote this intercourse to some extent, but the British Association presents to the young student during its week of meetings easy and continuous social opportunities for making the acquaintance of leaders in science, and thereby obtaining their directing influence. It thus encourages, in the first place, opportunities of combination, but, what is equally important, it gives at the same time material assistance to the investigators whom it thus brings together. The reports on the state of science at the present time, as they ap-

pear in the last volume of our Transactions, occupy the same important position, as records of science progress, as that occupied by those reports in our earlier years. We exhibit no symptom of decay.

Our neighbors and rivals rely largely upon the guidance of the State for the promotion of both science teaching and of research. In Germany the foundations of technical and industrial training are laid in the Realschulen and supplemented by the higher technical schools. In Berlin that splendid institution, the Royal Technical High School, casts into the shade the facilities for education in the various Polytechnics which we are now establishing in London.

For developing pure scientific research and for promoting new applications of science to industrial purposes the German Government, at the instance of von Helmholtz and aided by the munificence of Werner von Siemens, created the *Physikalische Technische Reichsanstalt* at Charlottenburg. This establishment consists of two divisions. The first is charged with pure research, and is at the present time engaged in various thermal, optical, and electrical and other physical investigations. The second branch is employed in operations of delicate standardizing to assist the wants of research students. As a consequence of the position which science occupies in connection with the State in Continental countries, the services of those who have distinguished themselves either in the advancement or in the application of science are recognized by the award of honors; and thus the feeling for science is encouraged throughout the nation.

Great Britain maintained for a long time a leading position among the nations of the world by virtue of the excellence and accuracy of its workmanship, the result of individual energy; but the progress of mechanical science has made accuracy of work-

manship the common property of all nations of the world. Our records show that hitherto, in its efforts to maintain its position by the application of science and the prosecution of research, England has made marvellous advances by means of voluntary effort, illustrated by the splendid munificence of such men as Gassiot, Joseph Whitworth, James Mason and Ludwig Mond; and, whilst the increasing field of scientific research compels us occasionally to seek for Government assistance, it would be unfortunate if by any chance voluntary effort were fettered by State control. The British Association has contributed £60,000 to aid research since its formation.

The other voluntary agencies to research, including those which the Government carries on for its own purposes, are too numerous to print here. For direct assistance to voluntary effort the Treasury contributes £4,000 a year to the Royal Society for the promotion of research, which is administered under a board whose members represent all branches of science. The Treasury, moreover, contributes to marine biological observatories, and in recent years has defrayed the cost of various expeditions for biological and astronomical research, which in the case of the Challenger expedition involved very large sums of money. In addition to these direct aids to science, Parliament, under the Local Taxation Act, handed over to the County Councils a sum, which amounted in the year 1893 to £615,000, to be expended on technical education. In many country districts, so far as the advancement of real scientific technical progress in the nation is concerned, much of this money has been wasted for want of knowledge. And whilst it cannot be said that the Government or Parliament have been indifferent to the promotion of scientific education and research, it is a source of regret that the Government did not devote some small portion of this magnificent gift

to affording an object lesson to County Councils in the application of science to technical instruction, which would have suggested the principles which would most usefully guide them in the expenditure of this public money. Government assistance to science has been based mainly on the principle of helping voluntary effort.

The Kew Observatory was initiated as a scientific observatory by the British Association. It is now supported by the Gassiot trust fund, and managed by the incorporated Kew Observatory Committee of the Royal Society. This institution carries on to a limited extent some small portion of the class of work done in Germany by that magnificent institution, the Reichsanstalt at Charlottenburg, but its development is fettered by want of funds. British students of science are compelled to resort to Berlin and Paris when they require to compare their more delicate instruments and apparatus with recognized standards. There could scarcely be a more advantageous addition to the assistance which Government now gives to science than for it to allot a substantial annual sum to the extension of the Kew Observatory, in order to develop it on the model of the Reichsanstalt.

The various agencies for scientific education have produced numerous students admirably qualified to pursue research; and at the same time almost every field of industry presents openings for improvement through the development of scientific methods. For instance, agricultural operations alone offer openings for research to the biologist, the chemist, the physicist, the geologist, the engineer, which have hitherto been largely overlooked. If students do not easily find employment it is chiefly attributable to a want of appreciation for science in the nation at large. This want of appreciation appears to arise from the fact that those who nearly half a century ago directed the movement of national education were

trained in early life in the universities, in which the value of scientific methods was not at that time fully recognized. Hence our elementary and even our secondary and great public schools neglected for a long time to encourage the spirit of investigation which develops originality. This defect is diminishing daily.

There is, however, a more intangible cause which may have had influence on the want of appreciation of science by the nation. The Government, which largely profits by science, aids it with money, but it has done very little to develop the national appreciation for science by recognizing that its leaders are worthy of honors conferred by the State. Science is not fashionable, and science students—upon whose efforts our progress as a nation so largely depends—have not received the same measure of recognition which the State awards to services rendered by its own officials, by politicians, and by the Army and by the Navy, whose success in future wars will largely depend on the effective applications of science.

The reports of the British Association afford a complete chronicle of the gradual growth of scientific knowledge since 1831. They show that the Association has fulfilled the objects of its founders in promoting and disseminating a knowledge of science throughout the nation. The growing connection between the sciences places our annual meeting in the position of an arena where representatives of the different sciences have the opportunity of criticizing new discoveries and testing the value of fresh proposals, and the presidential and sectional addresses operate as an annual stock-taking of progress in the several branches of science represented in the sections. Every year the field of usefulness of the Association is widening. For, whether with the geologist we seek to write the history of the crust of the earth, or with the

biologist to trace out the evolution of its inhabitants, or whether with the astronomer, the chemist and the physicist we endeavor to unravel the constitution of the sun and the planets or the genesis of the nebulae and stars which make up the universe, on every side we find ourselves surrounded by mysteries which await solution. We are only at the beginning of work.

I have, therefore, full confidence that the future records of the British Association will chronicle a still greater progress than that already achieved, and that the British

eral lake-like expanses usually represented as being at the head of some very small stream, I began inquiries concerning them and followed this up by visiting several of the largest.

Parenthetically, I may say that Darlington is well out on the loose sands and clays of the coastal plain (see Fig. 1), and while the main streams have cut down 30 to 40 feet beneath the general level of the country, yet their side streamlets are small, and much of the inter-stream surface is poorly dissected and but slightly changed from

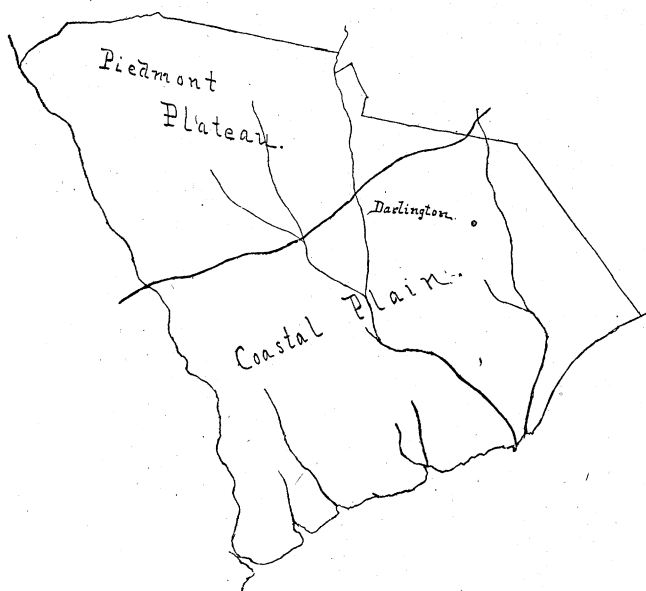


Fig. 1. Map of S. C., showing position of Darlington on the coastal plain.

nation will maintain its leading position amongst the nations of the world, if it will energetically continue its voluntary efforts to promote research, supplemented by that additional help from the Government which ought never to be withheld when a clear case of scientific utility has been established.

SOME NOTES ON DARLINGTON (S. C.), 'BAYS.'

HAVING noted on a surveyor's map of my school district of Darlington, S. C., sev-

the condition in which it was uplifted from sea bottom. This inter-stream surface is very level, the slope being about one foot per mile; the streamlets are weak; and extensive systems of ditches are necessary to keep the upland drained for cultivation.

To the lake-like expanses the term 'bay' is usually applied, and by it is meant a perfectly flat, clayey area with a surface some two to four feet below the general level of the country and varying from a few acres in size to stretches a mile or two long and a

half mile or more in width; the smaller ones being much more numerous and having usually an area of 20 to 30 acres. They are in some cases approximately round in shape, though they are usually ovoid or el-

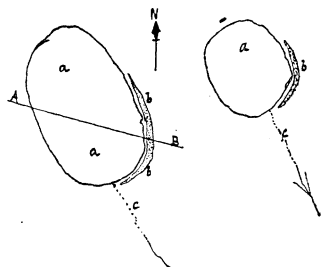


Fig. 2. Sketch map of a 'bay.' a, 'bay'; b, sand ridge; c, intermittent outflow to a stream near by.

liptical (see Fig. 2), and are covered with vegetation-stained water from a few inches to a foot or two deep, according to the season. Growing in this water, where the 'bay' is uncleared, are cypress, juniper or black-gum trees with a moderately thick swamp undergrowth.

Except when overflowed in a rainy season, there is often in the smaller 'bays' no permanent drainage. In the larger ones a small streamlet usually rises. When cleared for cultivation, the first requisite is to dig a ditch to the nearest stream or main ditch sufficiently deep for thorough drainage.

A sand ridge borders each 'bay' on the east and southeast and sometimes extends fairly well round toward the south, but is never found, so far as I could ascertain, on the west or north (see Fig. 2, b). The size of this sand ridge varies with the size of the 'bay,' rising in some well-pronounced cases 5 or 6 feet above the general level in the highest part and thinning out near both ends. In the usual case, however, it rises only some 2 or 3 feet above the general surface level. The width of the ridge varies from a rod to three or four rods. The

transverse surface curvature is most often uniform, or if more precipitous on one side than on the other no law could be found governing such variation (see Fig. 3).

A gentleman owning large tracts of land containing 'bays,' and having been a close observer of them, gave me much information and went a number of times to visit them with me. He called my attention to the fact that on first attempting to drain them for cultivation he had tried cutting ditches through this sand ridge, but found that the sand caved so easily (being, in a few cases, very quick) that it was very difficult to dig and keep such ditches open. The sand I thus found extended down below the surface of the adjacent sands and clays. How deep I could not find by direct test, probably not deeper at farthest than 15 to 25 feet, if nearly as deep as that, which I doubt. It is a rounded sand and, though used in Darlington for mortar, is very poor for building purposes. No fossils could be found in it so far as I searched. No stratification was visible. It is agriculturally extremely poor, and from its characteristic whiteness may be detected

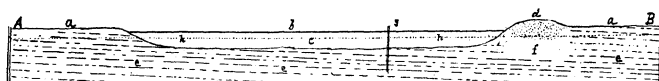


Fig. 3. Section 'through a bay' on line A B in Fig. 2. A B, general surface level; b, surface of 'bay'; c, clay filling basin of 'bay'; d, sand ridge; e, loose sands and clays dipping gently southeast; f, unknown part; g, pump; h, water level.

in a field that has been tilled for years. It seems to be a beach sand.

The basin (see Fig. 3, c) when drained shows a dark fertile, compact clay, impervious to water and with no fossils so far as a rough search could detect. This clay extends down some 15 to 25 feet, as is proved by driven wells that have been forced down through it. No water is got-

ten until the pipe reaches the underlying sand, when the water at once rises to the general water level, within 6 or 8 ft. of the surface. (See Fig. 3, g and h.)

Other duties prevented my mapping the large number of 'bays' that occur, to see what relationship, if any, could be discovered from their position. They seem to be scattered irregularly over the flat surface, some nearer the present coast than others. Whether they arrange themselves along certain lines I cannot say.

By some the sand ridges are attributed to wind action. This, however, would require a region free of vegetation, and we do not know that this one ever was so over any broad area. Besides, the wind would pile the dunes on *other sides* of the 'bays' than the east and southeast, unless it blew always from the east or southeast—a supposition of which no proof can be given. Finally, wind action is insufficient to account for the bases of the sand ridges extending beneath the general surface of the adjacent sands and clays.

From an examination of the Coast Survey charts of the Albemarle and Pamlico Sound region, I was at first led to conclude that I had in the 'bays' the results of numerous repetitions on a smaller scale of what is now going on in these sounds—the difference in the *size* of the bodies compared being great, but their agreement in *process* being strong. Each sound is a drowned valley with a bottom 15 to 25 feet deep at most and, being cut off from the ocean by the sand bar thrown across its mouth, they are slowly silting up with the very fine material brought down by the sluggish streams that empty into them. If present conditions continue long enough they will be filled with a fine, compact clay, and are already skirted on the southwest and east by a sand dune. There is an apparent analogy. The former sea where Darlington now stands—though deep shortly before

this from the thick beds of fuller's earth which must have been very gently deposited far from shore sands—was shallow, as is shown by the marl deposits near the surface and by the sands over all the region showing false or cross bedding and containing in some places moderate sized quartz pebbles. The shore line must have been low. Streams were probably numerous and small, no large drainage basins having been formed. Allow time enough for a little cutting of their channels by these newly-born streams, then a very small downward oscillation of the land,* let the headlands be beaten off and bars thrown across the mouth of the drowned streams while the enclosed basin slowly fills with fine sediment, and finally let the whole region gradually rise as it has done in fact, and we have a theory of their origin (see Fig. 4).

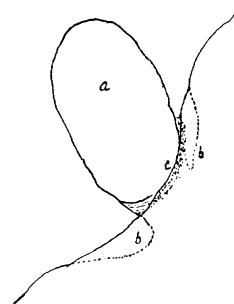


Fig. 4. *Theoretic Origin.* *a*, soundlet being enclosed; *b*, headlands beaten-back; *c*, bar thrown across mouth of sound.

This theory, however, is open to certain objections. No remains of an old stream channel entering this 'bay' is found. The existence of old beaten-off headlands on either side has been asked about. If these exist they are too faint to have made themselves noticeable when not looked for. They may exist in the case of the larger ones. The irregular distribution toward

*See Prof. Shaler's 'Fresh Water Morasses, etc,' 10th An. Rept. U. S. Geol. Sur., pp. 330-331, for numerous such oscillations recorded near this region.

the present shore is another difficulty. The prevailing rounded or elliptical shape is not explained.

That the sea, when this part of the coastal plain rose above it, left numerous inequalities somewhat similar to the ripple-made pittings seen in the sand in the bottom of a gutter after a rain has suggested itself to me. If so, these basin-like pittings—separated from each other by sand ridges highest above the general shore slope on their east side—might have formed the basins for these ‘bays.’

Fuller observation and study is needed before anything but a tentative conclusion may be reached. Any additional observations or suggestions will be gladly welcomed.

L. C. GLENN.

DARLINGTON, S. C.

A NEW METHOD OF DETERMINING THE MOTION OF STARS IN THE LINE OF SIGHT.

A METHOD of measuring the motions of stars in the line of light, which does not require the use of an artificial comparison spectrum, and which is therefore adapted to slitless spectroscopes, has been proposed by Professor Orbinsky, of Odessa (*A. N.* 3289). It is of unusual interest because the object-glass spectroscope, which is so advantageous with respect to simplicity of construction and to the brightness of the spectra which it yields, has never yet been successfully applied to this branch of astronomical research.

The principles on which the method depends may be briefly described as follows: If a luminous body is moving in the line of sight, the distance between any two lines in its spectrum is not what it would be if the body were at rest, since the two lines are unequally displaced by the motion. In a normal spectrum the displacement of the lower line would be somewhat the greater, although the differ-

ence would scarcely be measureable under ordinary circumstances, but on account of the increasing dispersion of a prism toward the violet the effect in a prismatic spectrum is reversed, and the upper line is displaced more than the lower one. The differential displacement of the $H\delta$ and $H\beta$ lines, in an ordinary prismatic spectroscope, is, in fact, somewhat more than half the absolute displacement of the $H\gamma$ line. By measuring this apparent change of dispersion the motion of a star can be determined.

To avoid the errors attending the measurement of large distances on a photograph, and other errors which need not be specially mentioned here, the spectrum of a star whose motion in the line of sight is known is photographed on the same plate, and the apparent change of dispersion due to the motion of the first star is deduced from measures referred to corresponding lines in the spectrum of the second. The stars selected for purposes of comparison would naturally be bright stars with well-defined lines, and their motions could therefore be accurately determined by the usual methods. Only a comparatively small number of such standard stars would be required.

For slit spectroscopes it would probably be found that Professor Orbinsky's method is inferior to the usual one, although Professor Vogel finds that it can be applied to some of the photographs taken with the Potsdam spectograph. It not only depends upon a differential effect, and thus reduces the amount of the available displacement, but it requires the measurement of lines which are widely separated, and therefore badly defined in consequence of their great distance from the axis of the camera objective. Even if this lens were constructed with a view to giving a large field the definition would be inferior to that in the center of the field of an objective of the usual construction.

The latter objection does not apply, however, to the case of a telescope with object-glass prism, where a great linear extent of spectrum is obtained with small angular field. It is for instruments of this class that the method is intended, and it seems to promise well. Possibly the range of spectrum could be advantageously increased by the use of orthochromatic plates, which, largely on account of the compression in the lower part of the prismatic spectrum, have an actinic value in the region of $\lambda 550$ not greatly inferior to that near H ϵ . It is true that few spectra have strong lines in this region. Various advantages and disadvantages attending the use of such plates will readily occur to the observer acquainted with their peculiarities, and actual trial would probably be necessary to determine on which side the balance lies.

J. E. K.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION OF ZOÖLOGY.

By reason of the absence of both the Vice-President and the Secretary-elect, the work of the section was somewhat delayed and embarrassed. Mr. L. O. Howard, of Washington, D. C., was nominated by the Council for Vice-President and was duly elected by the Association. Following the work of the general session, Section F. proceeded to complete its organization. Chas. W. Hargitt, of Syracuse, N. Y., was elected Secretary. Chas. S. Minot, of Boston, Mass., was elected Councillor, and George Dimmock was elected as a member of the nominating committee.

The following papers were read on Friday: *The Evolution of the Insect Mouth-parts.* By PROF. JOHN B. SMITH, Rutgers College.

Beginning with the typical mandibulate mouth the author undertook to show the the gradual modification of these parts in the structure of the mouths of all insects,

and further to show that there is no well-defined basis for the distinction of insects into mandibulate and haustelate groups. The paper was a very elaborate discussion of the subject and was listened to with the closest attention. It was illustrated by a series of lantern transparencies prepared by the author or under his direction.

Following this a paper was read by Mr. C. L. Marlatt, of Washington, D. C., on the Mouth-parts of Insects with Special Reference to the Diptera and Hemiptera.

In this paper the author sought to maintain the usually accepted view. It was illustrated by a series of charts and drawings and was a valuable contribution to the subject. Following this there was an animated discussion in which several entomologists participated.

The next paper on the program was by Prof. Chas. S. Minot on the 'Olfactory Lobes.' The paper was a noteworthy contribution to the subject.

Another important contribution to morphology was a paper on the 'Visceral Anatomy of the Lacertile,' by Prof. E. D. Cope.

On Monday morning occurred the joint session of sections F. and G., at which the following papers were presented:

The Distinction Between Animals and Plants.

By PROF. J. C. ARTHUR.

Variation After Birth. By PROF. L. H. BAILEY. Read by title.

Rejuvenation and Heredity. By PROF. CHAS. S. MINOT.

This paper was a noteworthy contribution to the subject of heredity, and was distinguished by its very forcible antagonism of the views of Weismann and his school.

The following papers were presented at subsequent sessions:

Stemmiulus as an Ordinal Type. By O. F. COOK.

From abundant material collected by Mr. Cook in Siberia, a more extended examination has been made possible and

characters discovered which he claims justify the recognition of *Stemiulus* as an Ordinal Type.

Characters which are Useful in Describing Larvæ of Sphingidæ. By GEO. DIMMOCK.

In this paper the author emphasizes the importance of measuring and describing the head, noting the granulations and rugosities of the surface of the Larvæ, and the structure and coloration of the stigmata.

The Affinities of the Pythonomorph Reptiles. By E. D. COPE.

This paper was discussed in Prof. Cope's usually lucid style, and was illustrated by blackboard sketches.

Temperature Variations of Cattle Observed During Extended Periods of Time, with Reference to the Tuberculosis Test. By JULIUS NELSON.

In this paper the author discussed an extended series of experiments made upon a herd of twenty-eight cattle upon the farm of the New Jersey Agricultural Experiment Station. A graphic representation of the experiments was made by means of carefully executed charts. Very important results were indicated which give promise of great value.

*On the Girdling of Elm Twigs by the Larvæ of *Orgyia leucostigma*, and its results.* By J. A. LINTNER.

Notes upon the Eupaguridæ. By CHAS W. HARGITT.

This paper reviews characteristic morphological and physiological traits of the family and discusses their bearing on the subject of heredity.

On a Revision of the North American Craspedosomatidæ. By O. F. COOK.

A New Character in the Colobognatha, with Drawings of Siphonotus. By O. F. COOK.

A New Wheel for Color Mixing in Tests for Color Vision. By J. H. PILLSBURY.

Some Further Results of Investigation of Areas of Color Vision in the Human Retina. By J. H. PILLSBURY.

*A Study of *Panorpa* and *Bittacus*.* By E. P. FELT.

The following resolutions relative to the proposed International Bibliographical Bureau were adopted :

WHEREAS, The date of publication is a question of fact to be determined by investigation and not by arbitrary ruling, and

WHEREAS, In the world at large the date of publications of books is the date at which they are printed, and

WHEREAS, The adoption of any other date would have no practical effect for this reason, and for the following reasons, viz.:

First, The majority of publications are not distributed but sold;

Second, The distribution when it occurs may be rendered ineffective by accidents such as fires, loss by mail, etc.;

Third, Distribution by individuals may be delayed or prevented by absence from home, sickness or death;

Fourth, Distribution by governments is often delayed for routine reasons;

Fifth, The actual date of mailing will often be impossible to ascertain with certainty owing to lack of record or irregularity in the period of transmission, and

WHEREAS, The determination of the date of printing will be generally found in the records of the printing office and can be established by the testimony of several disinterested persons, while the time of mailing will be known generally by but one person, therefore

Be it Resolved: First, that the Zoölogical Section of the American Association for the Advancement of Science recommends that the date of the completion of printing of a single issue be regarded as the date of publication; and

Second, that the Section recommends that such date be printed on the last signature of all publications, whether books, periodicals or separates.

Resolved further: 1, That the Section of

Zoölogy is impressed with the desirability of introducing the custom of placing all publications on record at some central agency together with the date of publication;

2, That a committee be appointed to obtain the approval of these resolutions by publishing societies at home and abroad;

3, That a copy of these resolutions be transmitted to the British Association for the Advancement of Science, the Zoölogical Society of London, the Australasian Association for the Advancement of Science, the Association Francaise, the Soc. Zoöl. de France, der Versammlung der Naturforscher und Aerzte, and the International Congress of Zoölogists.

The following committee was appointed: S. A. Forbes, Champaign, Ill.; E. A. Birge, Madison, Wis.; W. A. Locy, Lake Forest, Ill.; Geo. Dimmock, Canoble Lake, N. H.

Following were elected officers of the Section for coming year: Vice-President, Theodore Gill, Washington, D. C.; Secretary, D. S. Kellicott, Columbus, Ohio.

CHARLES W. HARGITT.

SYRACUSE, N. Y.

THE INDEXING OF CHEMICAL LITERATURE.

THE committee on indexing chemical literature, consisting of H. Carrington Bolton, chairman, F. W. Clarke, Albert R. Leeds, Alexis A. Julien, John W. Langley, Albert B. Prescott, Alfred Tuckerman, presented to the Chemical Section of the A. A. A. S. its thirteenth annual report, which is as follows:

During the twelve months which have elapsed since the last report the following bibliographies have been printed:

1. Indexes to the Literature of Cerium and Lanthanum. By W. H. Magee. Smithsonian Miscellaneous Collections, No. 971. Washington, 1895. 43 pp. 8vo.

2. Index to the Literature of Didymium, 1842-1893. By A. C. Langmuir. Smith-

sonian Miscellaneous Collection, No. 972. Washington, 1895. 20 pp. 8vo.

These bibliographies of three associated metals fill an important gap in chemical literature. That by Dr. Langmuir is reprinted from the School of Mines Quarterly (Vol. XV.), at the request of your Committee. Both indexes are arranged chronologically and provided with author-indexes.

3. Bibliography of Aceto Acetic Ester. By Paul H. Seymour. Smithsonian Miscellaneous Collections, No. 970. Washington, 1894. 148 pp. 8vo.

This bibliography was compiled by the author under the direction of Prof. Albert B. Prescott, and by him submitted to the Committee who recommended its publication August 22, 1892. It consists of a series of carefully prepared, critical abstracts of original papers arranged chronologically with author- and subject-indexes.

After issuing the twelfth annual report the attention of the Committee was directed to two contributions to the bibliography of chemical and pharmaceutical periodicals by Dr. Friedrich Hoffmann, editor of *Pharmaceutische Rundschau*, viz.:

4. Die Deutsch-sprachlichen pharmaceutischen Zeitschriften. *Pharm. Rundschau*, New York, Vol. XII., pp. 7-10 (Jan., 1894) and p. 28 (Feb., '94).

5. English-sprachliche pharmaceutische, chemische und botanische Zeitschriften Nord-Amerika's. *Pharm. Rundschau*, New York, Vol. XII., pp. 131-136 (June, 1894).

Several chemists have made reports of progress.

Prof. Henry Trimble, of Philadelphia, states he continues to collect references to the literature of the Tannins with the expectation of further publication at no very distant date.

Prof. Arthur M. Comey reports that his Dictionary of Solubilities, Vol. I., is nearly all in type, and should appear early in the autumn.

Dr. Alfred Tuckerman expects to complete the MS. of his Index to the Mineral Waters of all Nations in a few months.

Prof. F. W. Clarke is making progress with a new edition of the Recalculation of the Atomic Weights.

Dr. H. Carrington Bolton reports having done much work on the Supplement to his Bibliography of Chemistry, the MS. now comprising about 6500 titles.

Mr. C. LeRoy Parker, of the Columbian University, Washington, has undertaken an Index to the Literature of Attempts to Decompose Nitrogen.

Mr. George Estes Barton, of the same institution, is at work on a Bibliography of Glycerol; and Mr. George Baden Pfeiffer, also of the Columbian University, is engaged on a Bibliography of Picric Acid and the Nitrophenols.

At the request of the Smithsonian Institution, Dr. H. Carrington Bolton has undertaken to edit a new edition of his 'Catalogue of Scientific and Technical Periodicals, 1665-1882,' published in 1885 in the Smithsonian Miscellaneous Collections. The new edition will bring down to date the old periodicals and include new ones established since 1882. The work is well under way.

Mr. W. D. Bigelow, of the Chemical Division of the U. S. Department of Agriculture, has completed the MS. of an Index to Methods for the Detection and Estimation of Fusel Oil in Distilled Liquors. The channel of publication has not been determined.

In a communication to the chairman, Professor W. Percy Wilkinson, of Melbourne, states he is engaged on an Oenological Bibliography, to include works relating to the vine, viticulture, wine-making, vine-diseases and wine-analysis, published in Germany, France, England, America, Italy, Portugal and Spain. He expects the bibliography to number 2000 titles and will give

full details as to date, size, editions, etc. It is to be published by the Royal Society of Victoria.

Monsieur G. Fr. Jacques Boyer, editor of the *Revue Scientifique*, Paris, announces the preparation of a Bibliography of Physical and Chemical Science; information as to its scope and period is lacking.

Those interested in the chemical applications of electricity should note the following:

'Elektrotechnische Bibliographie; monatliche Rundschau über * * * der Elektrotechnik. Von Georg Maas,' Leipzig, 1893.

Also: 'Leiner's Elektrotechnischer Katalog * * * von 1884 bis 1893.' Leipzig, 1893. 8vo.

The following special bibliography has recently appeared in France: 'Bibliographie de la technologie chimique des fibres textiles. Propriétés, blanchiment, teinture, matières colorantes, impression, apprêts. Par J. Garçon. Paris, 1893. 8vo.' This work has been honored with a prize by the 'Société industrielle de Mulhouse.'

Although not pertaining to chemistry, we may briefly note the appearance of another special bibliography; 'Bibliographie der psycho-physiologischen Litteratur des Jahres, 1893. Hamburg, 1894. 8vo.' Published in the *Zeitschrift für die Psychologie und Physiologie der Sinnesorganen*.

Attempts to establish a comprehensive Index to Chemical Literature in the form of a periodical are not altogether successful, lacking the important element of permanence. The 'Index' announced by Dr. Bechhold, of Frankfort-on-Main, noticed in our Twelfth Report, has not made its appearance; the 'Biblioteca Polytecnica' by Szczepanski ceased at the close of one year; the 'Universal Index' by Wien and Brockhaus reached only nineteen numbers. Dr. J. Ephraim advertises the following: 'Index der gesammten chemischen Litteratur (Wissenschaft und Technologie), Berlin,' but no number has yet appeared.

ANTARCTIC EXPLORATION.

MR. C. E. BORCHGREVINK contributes to the *London Times* an article on 'Antarctic Exploration,' in which he deduces reasons, both commercial and scientific, in favor of undertaking an expedition toward the South Pole in the near future. The recent Antarctic expedition was a commercial venture, and was equipped with the object of capturing the 'black whale,' valuable for its whale bone. The failure to accomplish this object is attributed by Mr. Borchgrevink to the fact that the expedition did not penetrate far enough into the large open bay in the vicinity of the volcanic peaks, Erebus and Terror. This bay and South Victoria Land were discovered by Sir James Clark Ross in 1841, whose predictions that large numbers of the black whale would be found in the southern latitudes Mr. Borchgrevink believes will be verified in the future. The blue whale is present in large numbers, but in the recent expedition (the first since 1841) these could not be captured owing to the lack of proper appliances. There is also a probability of finding many seals. The guano beds discovered by the 'Antarctic' are reported to be well worth the attention of business men. From the analysis of specimens of rock brought back from the mainland there is a possibility, or even a probability, of the presence of valuable minerals. The discovery of vegetation on the mainland also materially increases the possibilities. Mr. Borchgrevink considers it undesirable, while practically little is known of the many hundreds of miles further north, to attempt at present to reach the pole, but urges that if this can eventually be reached the value of observations made at the south magnetic pole would be of very great scientific value.

Mr. Borchgrevink then describes the plans proposed for the expedition which he hopes will be undertaken next season. It

has been suggested that the members of the expedition, with appliances and food, should be taken to Cape Adare in a whaling vessel and left there until the ice breaks up in the following summer; that the whaler should then take in cargo, sail for Australia and pick up the exploring party (which would go into winter quarters on the peninsula at Cape Adare) on the return voyage. Mr. Borchgrevink, however, urges that a small vessel (say of 200 tons), to fall back upon in case of need, would greatly add to the safety of the party. A small light vessel would be able to encounter dangers which would be insuperable for a bulkier craft. Mr. Borchgrevink considers the number of men sailing with the expedition should not exceed twelve and that these should be chiefly composed of men of culture. Besides the ordinary outfit on board, which should be of the best, it would be necessary to include two good whaling guns with harpoons and other tackle, Norwegian ski and Canadian snowshoes with necessary footgear. The expedition should also have a sufficient number of sledges, and to drag these a large number of Eskimo dogs would have to be procured. Fuel for 18 months would form a very important item.

Mr. Borchgrevink also recommends two or three semi-globular shaped huts, composed of hard wood, so built as to withstand the pressure of the snow and the force of the wind, and covered with some material capable of resisting a possible rain of stones from the adjoining volcanic craters. A captive balloon with the necessary appliances on the vessel would be extremely valuable, both for the purpose of ascertaining the exact location of open water within the pack, and also to enable a closer view of the magnificent aerial phenomena appearing in these latitudes. It would be desirable also to include letter-carrying balloons in the outfit.

CURRENT PROBLEMS IN PLANT MORPHOLOGY (II.).

THE INFLUENCE OF SPRAY AND RAIN ON THE FORMS OF LEAVES.

THE interesting work of Stahl*—based upon observations made at the Buitenzorg gardens, and thus indicating tropical conditions and recording tropical results—served to direct attention towards those adaptive form-modifications which leaves take when subjected to excessive rainfall. That the points and serrations of the leaves were in such cases usually prolonged and slender; that the leaves frequently adopted a vertically suspended position; that the nerves in many cases were sunken in gullies, thus making channels from which the superfluous water easily escaped; that the arrangement of hairs on leaves and stems contributed to the ready dispersion of water, were among the facts made clear in this contribution. Previous students, as, for example, Lundström† and Wille,‡ had already brought out some of these, but Stahl's work is noteworthy from its novel points of view as well as for its solid additions to the knowledge of the subject. Of particular interest is his summing up of the ecologic importance of rain specializations in tropical leaves. That it is necessary to disburden the leaves of their weight of moisture; that this superfluous water must be conducted to the roots and not intercepted by the crown; that the upper sides of the leaves must be freed from attached epiphytic algæ, fungi and lichens; that the transpiration stream, passing with difficulty from a leaf the surface of which is wet, must be promoted by the rapid drying off of the surface, are some of the rea-

sons brought forward to account for the morphological peculiarities of the rain leaves.

The most peculiar single form-character of the rain leaf is the elongated point or '*Träufelspitze*,' and this has been shown to be characteristic not only of tropical plants subjected to a rainy season, but of strand plants subjected to the ocean spray, of high mountain and plateau plants subjected to heavy dews and of temperate zone plants where the rainfall is excessive.

Jungner,* whose earlier researches have contributed to the subject,† brings out a valuable paper in which considerable direct experimental work is recorded and several new observations are described. The most novel part of the work is the discussion of the influence of cataract spray upon the plants growing in the gorge beneath or beside the waterfall. '*Träufelspitzen*' are shown to characterize plants in such locations, and several figures showing the difference between normal habitat and spray habitat leaf forms are given. In such an habitat, too, the customary hairiness of the leaf is reduced, hairs having a tendency to retain the water too long, and peculiar groupings of the leaves on the stem, significant as arrangements for rapid draining off of water, were observed. The glazing by wax of the upper surface of the leaf in some cases served to reduce its 'wetableness.'

The most valuable part of the work, however, is the experimental portion in which it is shown how form-modifications may be produced in the greenhouse by subjecting leaves to regular dropping of water or to spray. The characteristic rain forms and spray forms were thus developed in a

(*) *Regenfall and Blattgestalt*. Leiden, 1893.

† *Die Anpassungen der Pflanzen an Regen und Thau*, Upsala, 1884.

‡ *Kritische Studien über die Anpassungen der Pflanzen an Regen und Thau*. Cohn's Beitr. Biol. Pflanz. 4: hft. 3.

* *Wie wirkt träufelndes und fliessendes Wasser auf die Gestaltung des Blattes?* Bibliotheca Botan. 32. Stuttgart. 1895.

† *Om regnblad, dagblad och snöblad*. Bot. Notiser No. 3, 1893, No. 3, 1894, and *Klima und Blatt in der Regio alpina*. Flora. 1894.

number of plants. Jungner properly distinguishes between ontogenetic rain leaves and phylogenetic. It is clear, however, that it is not necessary in every case to attribute the special form to any deeper effective cause than the direct influence of the environment. This whole line of experiments, recorded by Jungner, is a notable contribution to the modern literature of adaptation phenomena—a literature which on the whole is as richly and as sanely developed in the field of plant morphology as anywhere.

CONWAY MACMILLAN.

UNIVERSITY OF WISCONSIN

SCIENTIFIC NOTES AND NEWS.

THE next International Congress of Zoologists will be held in England in 1898 under the presidency of Sir William H. Flower. The International Congress of Physiologists will also hold its next meeting in England, having accepted the invitation to Cambridge given by Prof. Michael Foster.

FOUR American men of science were elected corresponding members at the recent meeting of the British Association: Professor John S. Billings, University of Pennsylvania; Professor D. H. Campbell, University of California; Professor H. F. Osborn, Columbia College, and General F. A. Walker, Boston.

AT the suggestion of Dr. H. Carrington Bolton the Smithsonian Institution is now corresponding with American universities for the purpose of making a collection of all printed Dissertations published by candidates for higher degrees.

M. PIERRE FAUVEL reported to the Paris Academy on September 9th that the severe cold of last winter was very destructive to the marine fauna of France, the mortality extending even to a depth at which the temperature could not have had any direct effect. Nearly the entire contents of the

dragnets, both of the marine laboratory and of the fishermen, consisted of animals dead and decomposed. Thus eighty per cent. of the scallops (*Pecten maximus*) were decomposed and the others were in such condition that they could not be sold. In the spring rare species and some new to the fauna of the coast were present in great abundance.

CAPTAIN LENOX-CONYNGHAM is in charge of a mission sent out by the British government for the purpose of determining the difference of longitude between Greenwich and Madras. After having finished operations at Odessa the mission will proceed to Batum and then on to Baku, Resht and Teheran. Facilities have been promised to this mission by the Russian and Persian governments.

SINCE the report on indexing chemical (see p. 478) was presented before the A. A. A. S., Mr. W. D. Bigelow's 'Index to Methods for the Detection and Estimation of Fusel Oil in Distilled Liquors' has been accepted for publication by the Journal of the American Chemical Society.

Prometheus, the German scientific journal, in Nos. 300–302, publishes an article, '*Der thierische Körper als Kraftmaschinen*,' translated from SCIENCE by Dr. Reuleaux, the Director of the Polytechnicum at Charlottenburg and author of '*Briefe aus Philadelphia*'; the latter famous for their frankness in revealing the defects of German manufactures and especially for their prompt effect in stimulating improvement. Professor Reuleaux prefaces Dr. Thurston's paper by an appreciative introduction, and supplements it by an interesting statement of his own ideas on the subject.

THE next meeting of the German Association of Naturalists and Physicians will be held at Frankfurt.

A TELEGRAM to the London *Times* states that Professor Anderson Stuart, of the Uni-

versity of Sydney, has invented an artificial larynx for a man who had lost his voice. The invention is a singular success. The changing of certain reeds contained in the instrument makes the voice soprano, tenor, contralto or bass, at will.

DR. HJALMAR HJORTH BOYESON, professor of Germanic languages and literatures in Columbia College, died on October 4th, at the age of 47 years. Professor Louis Polleus, professor of French in Dartmouth College, died on September 22d, at the age of 56 years.

PROFESSOR ELI WHITNEY BLAKE, who until last June filled the position of Hazard professor of physics in Brown University, died on October 1st, at the age of 59 years. The following particulars concerning his life are taken from the *Boston Transcript*. Professor Blake was born in New Haven, his father being the well-known inventor of the same name. He was graduated at Yale University in 1857, studied chemistry and physics in the universities of Heidelberg, Marburg and Berlin, and returning to this country was named professor of chemistry and physics in the University of Vermont and the State Agricultural College. He was then appointed professor of physics and mechanic arts at Cornell University; later he became acting professor of physics at Columbia College, and from 1870 until last June filled the chair of physics at Brown University.

THE following lines (we do not know at whose instance) have been engraved upon Huxley's tombstone:

"And if there be no meeting past the grave,
If all is darkness, silence, yet 'tis rest.
Be not afraid, ye waiting hearts that weep!
For God 'still giveth his beloved sleep.'
And if an endless sleep he wills, so best!"

DR. ELLIOT FOLGER ROGERS, instructor in chemistry at Harvard University, died on October 3d.

DR. ERNEST BAUMANN, the African explorer, died at Cologne on September 4th, at the age of 24 years.

MR. JAMES CARTER, paleontologist at Cambridge University, died recently at the age of 81 years.

DR. HEINRICH ADOLF BARDELEBEN, professor in the medical faculty of the University of Berlin, died recently at the age of 76. Dr. Bardeleben was the author of a number of important works, the principal of which is a text-book on Surgery and Surgical Operations, in four volumes, which has passed through a number of editions.

GENERAL O. M. POE, U. S. Engineer, died on October 1st.

THE German correspondent of the *N. Y. Evening Post* writes that Professor H. Kayser, Director of the Physical Institute in Bonn, has demonstrated that helium (as well as argon) exists in a free condition in nature. The waters of Wildbad, in the Black Forest, for instance, contain in the bubbles of gas rising continually to the surface (about 96 per cent. nitrogen), both those elements which on bursting escape into the surrounding atmosphere. Even in the natural air in Bonn, Professor Kayser found helium in a free state, but, as the spectroscope showed, in infinitesimal quantities.

HOUGHTON, MIFFLIN & Co. announce the publication in book form of Mr. Percival Lowell's articles on 'The Planet Mars,' reprinted from the *Atlantic Monthly*.

PROFESSOR VICTOR RYDBERG, the Swedish writer and archæologist, died on September 22d, at Stockholm, at the age of 67 years.

A REPRESENTATIVE of the Jackson-Darmsworth expedition has received a cablegram from Vardi beyond the North Cape with the news that the 'Windward,' after an exceptionally severe winter in the Arctic seas, had at last regained inhabited regions. Mr. Jackson and his party, in-

cluding equipment, dogs and provisions, had been safely landed on Franz Joseph Land, on September 7, 1895. Two days later ice closed round the 'Windward' and she was frozen in for the winter. The crew remained on the ship, but joined in the efforts of the explorers (who took up their abode in treble-walled Russian log houses which they had brought with them from England) in procuring fresh meat for food. When the ship left the explorers they were starting on their journey northward with good hopes of being able to explore successfully the unknown polar regions.

THE Dominion Medical Association held its twenty-eighth annual convention under the presidency of Dr. W. Bayard, on August 28th.

THE Rev. Dr. Williamson, professor of astronomy in Queens University, died on September 27th, in Kingston, Ontario, at the age of 87 years.

MR. EPHRAIM W. BULL, the well-known agriculturalist, died on September 26th, at the age of 89.

EXPERIMENTS in marching have been recently undertaken by students of medicine in the Friedrich Wilhelm Institute in Berlin, at the request of the German War Office. The results as reported in *The British Medical Journal* are as follows: The marches performed varied from 22 to 33 miles in length and were undertaken in all weather. The weights carried were from 48 to 68 pounds. A march of 25 miles undertaken at a temperature of 60° F. had no ill effect even if continued for some days consecutively, but under the same conditions at a temperature of 70° F. it necessitated a rest of at least ten hours in the twenty-four. A load of 68 pounds carried 25 miles produced grave physiological disturbance and necessitated a complete rest on the following day, but if the distance were reduced to fifteen miles 60 pounds

could be carried day after day in ordinary summer weather without injurious effects.

A LETTER written to the *American Machinist* states that the new rule allowing inventors six months instead of two years' time in which to prosecute an application for a primary examination went into effect April 15, 1895. Pending cases will be affected as though the last office decision were upon that date; therefore, all applications which were pending before that date should be amended or argued before October 15, 1895.

UNIVERSITY AND EDUCATIONAL NEWS.

THE fifth annual Report of the U. S. Commissioner of Education, Dr. William T. Harris, for the year ending November 30th, 1893, states that the entire number of pupils in the schools and colleges of the United States was 15,083,630, 22.5 % of the population, an increase of 370,697 over the previous year. The number of pupils enrolled in the public schools was 13,510,719, an increase of 1.92 %. The average attendance showed an increase of 3.45 %. The attendance for each child was only during about one-fifth of the year. 122,056 men and 260,954 women were employed in teaching. The number of schoolhouses was 235,426, valued at \$398,435,039. It is stated that the value of school property and the common school expenditure have more than doubled during the preceding twenty years. The report contains statistics of public high schools, professional educational institutions and normal schools, and includes a review of systems of education in foreign countries; reports of the International Congress of Education at the World's Fair; criticisms on American education by representatives of the German government at Chicago; a report on American technological schools by Professor Riedler, of the Royal Polytechnicum at Charlottenburg, near Berlin, and

the report of the committee of ten appointed by the National Educational Association upon the courses of instruction in secondary schools.

DR. EDMUND J. JAMES, professor of public finance and administration in the Wharton School of Finance and Economy, and professor of political science in the graduate department of the University of Pennsylvania, has accepted the professorship of public administration at the University of Chicago.

RICHARD E. DODGE, of the department of geography in Harvard University, has been appointed instructor in geography and geology in the Teachers' College, New York.

THE University of Pennsylvania expects an increase in the number of students in almost every department. The Freshman Class in the medical school numbers about 250, and the upper classes include 50 students from other institutions.

DR. ARTHUR D. FRIZELL has been appointed associate professor of mathematics in the University of the City of New York.

CORRESPONDENCE.

THE ABSORPTION OF TERRESTRIAL RADIATION BY THE ATMOSPHERE.

IN the issue of *SCIENCE* for August 16th Professor Hallock's account of Langley's bolometric studies contains the following statement: "Our atmosphere acts like a valve, transmitting in almost undiminished strength the short quick waves of energy radiated to us from the sun, but refusing absolutely to return the long slow waves in which the earth tries to radiate the energy back into space. Without this atmosphere we should all have been frozen long ago" (p. 178).

This leads to an interpretation of Langley's results so different from that which I have gathered from his writings that a brief comment on the subject seems desirable. It seems to me that Langley has shown that the solar rays find

the atmospheric valve badly clogged when they attempt to pass inward through it, and that the terrestrial rays find the valve very leaky when it tries to prevent their passage outward.

In the first place, regarding the entrance of solar rays, Langley found from his observations at Allegheny and Mt. Whitney that about half their energy is lost in passing down through clear air. He drew a curve to represent the distribution of energy in the spectrum of the high sun at Allegheny; the area included between the curve and its horizontal base line corresponding to 1.7 on a scale of calories. Another curve was constructed on the same base, but with ordinates representing the inferred distribution of energy in the solar spectrum outside of the atmosphere; the area here included corresponding to 3.5 calories ('Researches on Solar Heat,' Prof. Papers, U. S. Signal Service, XV., p. 144 and pl. XV.). Later statements increase the average percentage of transmission of the solar beam to 70% ('The Temperature of the Moon,' *Mem. Nat. Acad. Sciences*, 1888, IV., 89); but a valve that could, when open, allow only 70% of a current to pass through it would be regarded as a very imperfect mechanism.

In the second place, the action of the atmosphere on rays emitted from the earth is inferred chiefly from its action on rays emitted by the moon and by experimental radiators. The moon's spectrum is shown to consist of two parts; one part being simply reflected sunlight with its maximum energy in rays of 'luminous' wave-lengths; the other part being true lunar rays, emitted by true lunar radiant action, with their upper and lower limits at wave-lengths of one and perhaps fifty μ , and their maximum energy in wave-lengths of seven μ . These latter are in a spectral region of which no one had any knowledge whatever before Langley's studies about 1886. The solar rays, infra-reds as well as luminous and ultra-violet rays, are transmitted by glass, but the true lunar rays are entirely cut off by glass and must be studied with rock-salt prisms. The ratio of the energy of the solar rays reflected by the moon to that of the true lunar rays is as one to seven (*Mem. N. A. S.*, IV., 197; or *Amer. Journ. Science*, Dec., 1889, 435). As is the case with the rays

from other solid radiators, the lunar beam has the greatest quantity of energy in rays of greater wave-length than those of its maximum energy (A. J. S., 435), and this is a matter of great importance in the present connection. The air is practically opaque to the strongest of these rays, of wave-length about seven μ , for it is here that the 'great cold band' of the lunar spectrum occurs; yet in the region of the great body of coarser but weaker lunar rays the percentage of transmission rises to 70 or 80 (Mem. N. A. S., pl. 6 and 7; A. J. S., pl. X. and XI.). The average transmission of the whole lunar beam of emitted rays is estimated at 40% (Mem., 189). A valve with a leakage of 40% should not be spoken of as 'absolutely refusing' to let a current pass; it should hardly be called a valve at all. Assuming that terrestrial and lunar radiations are much alike, Langley's results seem to show that something more than half of the solar beam comes in through clear air, and something less than half of the terrestrial beam goes out. It can be only by the small amount of energy thus saved to our use that the temperature of the earth is maintained.

Regarding the process by which the earth maintains its existing temperature, there is an interesting suggestion by Prof. Arthur Searle, of the Harvard College Observatory, in a brief essay entitled 'Atmospheric Economy of Solar Radiation' (Proc. Amer. Acad. Arts and Sci., XXIV., 1888, 26-29), to which those who are interested in this problem may refer, and from which I quote the following sentence in order to show how others than myself read Langley's conclusions: "The hypothesis which has been current until recently with regard to this protective action of the atmosphere depended upon a supposed effect of selective absorption, which has now been largely, if not entirely, disproved by Langley's experiments" (p. 26).

The following quotations may indicate Langley's position regarding the 'valve' or 'trap' or 'hot-bed' action of the atmosphere: "Allegheny observations * * * show that a considerable part of this radiated [lunar] heat does pass through our atmosphere along with that reflected" (SCIENCE, 1st Ser., Jan. 1, 1886, 8). "Contrary to all previous experience, it [the lunar beam] nevertheless reaches us, thus bringing

evidence of the partial transparency of our terrestrial atmosphere even to such rays as are emitted by the soil of our planet" (Mem. N. A. S., 193). "To see how the question of the lunar heat affects our knowledge on the whole subject of our planet's temperature, we must remember that until a few years past it had been assumed by all writers of repute that the earth's atmosphere acted exactly like the glass cover of a hotbed, and kept the planet warm, in exactly the same way that the hotbed is warmed, by admitting the light-heat of the sun, which was returned by the soil in the invisible radiations of greater wave-length to which the atmosphere was supposed to be impervious, and that thus the heat was stored" (Mem., 110). Although no equally explicit announcement is made of the belief with which Langley would replace this assumption made by 'all writers of repute,' these extracts and quotations give reason to think that Professor Hallock's brief statement is over-strong in using such phrases as 'almost undiminished' and 'refusing absolutely.' The analogy of the valve needs so much qualification that it is not very serviceable in the way of explanation.

In this connection, a few words may be added on the matter of terminology, which I find very embarrassing. We all recognize that the careful definition of scientific terms is an important aid to careful thought, and that the use of a term loosely and vaguely is apt to tangle up the ideas of the hearer or reader, if not of the speaker or writer. The introduction to Maxwell's 'Theory of Heat' offers an excellent illustration of the care with which that masterful physicist used his terms (Appleton's Edition, 1883, p. 8, 9). He afterwards says: "Heat is certainly communicated from one body to another by a process which we call radiation, which takes place in the region between the two bodies. We have no right, however, to speak of this process of radiation as heat. We have defined heat as it exists in hot bodies, and we have seen that all heat is of the same kind. But the radiation between bodies differs from heat * * * in being of many different kinds * * * When we speak of radiant heat we do not mean to imply the existence of a new kind of heat, but to consider radiation in its thermal aspect"

(p. 15, 16). Yet, even Maxwell speaks of 'heat rays,' almost as if they objectively possessed heat, and, of course, with the implication that 'rays of light' are not 'heat rays.' Can it be urged too strongly that the rays differ objectively only in wave-length and amplitude, and that their relations to heat and light are entirely and absolutely subjective? Yet loose phrasing is continually met with. Langley writes of 'luminous heat' and of 'the radically different character of the heat in these two maxima' (A. J. S., *ut supra*, 434, 435). Hallock writes: "Then it was that heat was recognized as another manifestation of those periodic disturbances, or waves, in that elastic medium which was then known as the luminiferous ether, and which is now universally known as 'the ether' (SCIENCE, *ut supra*, 174). Perhaps this refers to the mis-recognition of the early part of this century; perhaps professional physicists get along comfortably enough with 'dark heat rays' and the rest; but to those who have to use physical results in other lines of study, this indefinite phraseology is very troublesome.

W. M. DAVIS.

HARVARD UNIVERSITY, Sept. 30, 1895.

SHELLS AS IMPLEMENTS.

PLEASE call the attention of those who own or have charge of archæological cabinets to an illustration in von den Steinen's 'Unter den Naturvölkern Zentral Brasiliens,' 1894, p. 207, fig. 27. A fresh water mussel shell has a hole through it just as you see in specimens on plate xxvi. of Holmes' paper 'Art in Shell.' But von den Steinen says that these shells are used as scrapers; the edge on large objects and the hole through the shell is also used by the tribes living on the upper Shingu for smoothing or scraping wood. His next remark about pushing the hole in with an Akuri nut I do not comprehend.

O. T. MASON.

THE INVERTED IMAGE ON THE RETINA.

IN the last number of this journal (p. 438) Professor Brooks writes: "We all believe many things which are inconceivable, such as the truth that the image in our eyes is upside down." But why is this inconceivable? To

those having knowledge of elementary physics it is inconceivable that the image should not be inverted. Perhaps Professor Brooks means that it is incomprehensible that we should see things right side up when the image is upside down. This is sometimes urged, but would seem to be sufficiently answered by a remark once made by Lotze in the presence of the writer: "If any one is troubled by the fact that the image is inverted, let him suppose that the soul stands on its head." It is, indeed, quite as reasonable to suppose that the mind stands on its head as to suppose that it stands on its feet and looks at the image on the retina—which would seem to be the assumption of those who are troubled by the phenomenon.

A similar paradox is the fact that with two images on the retinas we see things singly. This may also be treated without undue seriousness by the question: "If we hear a baby crying with two ears, why do we not think it is twins?"

J. MCK. C.

SCIENTIFIC LITERATURE.

Mental and. Physical Fatigue by M. Mosso. Translation by P. Langlois. (Bibliothèque de philosophie contemporaine.) Paris, Félix Alcan. 1894.

The Difference Between the Muscles in Their Normal and Their Abnormal, or Fatigued Condition by M. WEDENSKY. Archives de physiologie; Comptes rendus de l'Académie des Sciences.

It is but recently that problems of this nature have been treated by physiologists.

Kronecker, in his experiments on the detached muscles of the frog, succeeded in obtaining 1,000, even 1,500 contractions, the intensity of which decreased regularly in proportion to the increase of fatigue; thus, for contractions at regular intervals, produced by currents of equal intensity, the curve of fatigue is a straight line. Kronecker also observed the great individual differences existing in animals in their power of resistance to fatigue.

M. Mosso, the author of the present work (unfortunately abridged in the French translation), is an Italian physiologist who has undertaken with an instrument of his own invention,

which he calls an 'ergograph,' to measure the normal variations of muscular force in man. The work contains illustrations of the apparatus in question, as well as the various curves obtained by the experiments. The instrument consists: (1) of a small cushioned platform upon which the forearm rests, fastened down at the wrist in such a manner as to give free play to the fingers, the hand remaining immobile meanwhile; (2) a pulley, consisting of a wheel and cord, one end of which is attached to a weight and the other end to the finger to be experimented upon—usually the middle finger. To this cord, moving in a groove, is fixed a sliding pen, the point of which rests upon the registering cylinder above. At intervals of two seconds, marked by the metronome, the subject is expected to concentrate all his force on the muscles of the middle finger for the purpose of lifting the weight at the other end of the cord. The weight thus lifted was usually 3 kg. The line passing through the maxima of the contractions formed the curve of fatigue.

Experiments of this character are open to theoretical objection. It is evident, from the curves obtained by the registering cylinder, that the digital contractions are in no case instantaneous, and that each portion, or part, of a given contraction differs from the preceding or succeeding one. However, the conditions of M. Mosso's experiments were practically such that the variations of time between the different fractions of contraction were but slight. For all practical purposes, then, the curve thus obtained may be considered a curve of instantaneous effort in equal intervals of time.

Similar experiments, made upon himself by M. Aducco, a fellow-worker of the author, show two curves—one obtained in winter, the other in summer. They are not alike. These curves vary not only for different subjects, but also for the same subject under various conditions dependent upon the state of health or preceding muscular effort.

There is also given a curve of fatigue produced by an interrupted current applied in the same manner to the median nerve. The intensity was not at its maximum, but the author affirms that an increase of intensity aug-

ments but feebly the amplitude of the contractions. The curve thus obtained is essentially the same as that obtained by muscular contractions under the influence of the will, from which he concludes that physical fatigue is a phenomenon depending on the muscles rather than on the excitability of the nervous centers. Nevertheless, if we consider an effort of the muscles excited by the will and an effort of the muscles excited by electricity simultaneously, we find the former much greater than the latter.

It is known that fatigue engenders poisoning, and that the blood of an animal in this abnormal state, injected into another animal, will produce all the phenomena of fatigue. When the leg of a frog that is being operated upon becomes fatigued, the poison may be, so to speak, neutralized, and the contractions may be made to continue by injecting salt water in the artery which carries the blood to the muscles. In case of a total absence of blood, its place may be wholly supplied by salt water. The frog may in this manner be kept alive one or two days and continue to react during the first few hours like a frog in normal condition.

These poisons, under the name of *ptomaines*, are now being studied. But until we obtain the knowledge which will enable us to neutralize them chemically, it is well to know that their elimination may be facilitated by all the various operations calculated to accelerate respiration, massage, etc.

Severe intellectual labor diminishes the pulse, produces a fullness in the head, causes palpitation of the heart, pain in the brain and in the muscles of the eye, sometimes photophobia and often vertigo. Dyspepsia, also, is among its painful consequences. Violent muscular exercise has been prescribed as a remedy for all these ills, but this is shown to be a mistake. The only remedy is rest—a complete cessation of mental labor, the disturbing cause. The fact is that, after a prolonged physical effort, nervous excitement increases in proportion as muscular energy diminishes, and this excitement is apt to extend to other muscles which should not be brought into participation.

Another device of M. Mosso, a modification of the ergograph, which he calls the *ponomètre*, permits him to measure his *travail à vide*, as he

designates the uncontrollable, fruitless, nervous activity superinduced by over-fatigue, and which is so exhaustive to the nervous centers. He shows, furthermore, by his experiments on carrier pigeons, that excessive muscular fatigue produces anæmia of the brain. A slight modification in cerebral circulation is sufficient to impair the intellectual faculties and may even determine a swoon. In experiments made upon a subject named Bertino, the author produced syncope and convulsions by a compression of the carotid arteries—an opening of some half inch in the frontal region of his subject, enabling him to register the pulsations of the brain meanwhile.

Every one has heard of *curare*, first introduced into Europe in 1595. It is a dark-brown, solid substance contained in little earthen pots, as prepared by the Indians of South America, by whom it is used principally to poison their arrowheads for war and the chase. The active principle in curare is its curarine, a ternary substance consisting of azote, hydrogen and carbon. This substance has two remarkable qualities: Contrary to what is usually the case with vegetable poisons, it may be absorbed internally with impunity, and in fairly large doses (by mammals, at least), whereas in the form of hypodermic injections it becomes a violent poison. On the other hand, it does not affect the nervous centers—the mental powers, the sensitive nerves and the muscles, while paralyzing the motor nerve. It doubtless especially affects the terminal plate where the motor nerve unites with the muscle. It kills by arresting the heart's action.

Professor Wedensky, of the St. Petersburg University, has lately reproduced the paralyzing effect of curare by a very different process. With the electric apparatus of Dubois Raymond he excites the motor nerve by frequent and violent currents. Under the influence of this irritating treatment, the muscle, instead of contracting, relaxes almost completely, and its condition becomes analogous to that produced by the mysterious influence of the curare. As the intensity and frequency of these excitations are diminished, the muscle tends to resume its contractile power and to return to its normal state.

These experiments are of the greatest interest. They show the fatal consequences attending frequent and intense nervous effort; they permit us at the same time to calculate the danger of paralysis and to anticipate it. These new processes enable us to distinguish the normal muscle from the enervated muscle—that is to say, the muscle deprived of the influence of the spinal marrow and the nervous fibres—after long and intense irritation, whether caused by over-taxation of the brain or of the muscles.

Professor Wedensky calls attention to the fact that the enervated muscle in presence of the electric battery acts in a much simpler manner than the normal muscle when the excitations traverse the tissues in their entire length. The normal muscle, subjected to currents of gradually increasing intensity, will contract but slightly at first, then more, and then less again; whereas, the enervated muscle will increase its contractions with the intensified current, relaxing as the intensity diminishes. Furthermore, if a second current be added to the first, it will have no effect on the normal muscle, while for the enervated muscle the second current reinforces the first.

A stethoscopic auscultation of the muscles after frequent irritations will, in case of enervation, reveal sounds whose rhythm corresponds almost exactly with that of the induced current; the vibrations of the normal muscle, on the contrary, will be found to maintain their own independent rhythm.

Finally, it must be remarked that the normal muscle is much more excitable under the influence of an ascending current than a descending one. The contrary is the case for the enervated muscle, and even for the muscle that is simply fatigued.

From these facts results an important practical application, an exact method for the examination of cases of fatigue and paralysis. For instance, let the subject under examination clasp in his right hand the negative pole while the positive pole rests on his right foot; then ascertain the degree of intensity required to produce the least possible contraction of the muscles traversed by the current; whereupon reverse the order of the electrodes, placing the positive above and the negative below, thus subjecting

the same muscle to a descending current of the same character, the intensity of which, like the first, shall be the least perceptible. If the intensity of this latter current proves to be inferior to that of the former, the inference is that the muscular mass experimented upon is enervated. The greater the difference between the two degrees of intensity, the more serious will be the state of muscular enervation.

The great question for physiologists to answer now is: By what means are we to realize the full measure of muscular capacity in man and beast? The problem is in their hands, and the merit of MM. Mosso and Wedensky is that they have succeeded in studying experimentally some of the questions so deeply interesting to those engaged in this work.

CHARLES HENRY.

PARIS.

List of Mammals collected in the Black Hills Region of South Dakota and in Western Kansas by W. W. Granger, with field notes by the collector. By J. A. ALLEN. Bull. American Museum Nat. Hist., Vol. VII., pp. 259-274, Aug. 21, 1895.

The Black Hills region is one of more than ordinary interest to the naturalist, and it has received its full share of attention. Perhaps no area of equal size in the United States has been more closely studied by geologists and paleontologists, and it has been visited more than once by zoologists and botanists.

The special interest attaching to the Black Hills, from the standpoint of the living fauna and flora, centers in the fact that it is the easternmost of the outlying boreal islands belonging in a general way to the Rocky Mountain region. This was clearly indicated by the first report on its mammals and birds, published by Geo. Bird Grinnell in 1875. Since then it has been visited three times by the experienced mammal collector, Mr. Vernon Bailey, but the results of his labors have not yet been published. The present paper by Dr. Allen, based on a collection made by Walter W. Granger in 1894, is therefore the first enumeration of the mammals of the region since modern methods of trapping came into vogue.

Three life zones—*Boreal*, *Transition* and *Upper Sonoran*—are embraced in the area covered by the report, though this important fact is not recognized by the author. The higher parts of the Black Hills are *Boreal*; the lower slopes, embracing most of the pine forest, are *Transition*; the adjacent 'bad lands' south of the Cheyenne River are *Upper Sonoran*. The Boreal element is completely isolated, being separated by a wide interval from the nearest land of sufficient elevation to support a similar fauna and flora. The following Boreal species occur in the Black Hills: *Microtus longicaudus*, *Evotomys g. brevicaudus*, *Peromyscus l. arcticus*, *Neotoma cinerea* [= '*grangeri*'], *Sciurus h. dakotensis*, *Arctomys dakota*, *Sorex personatus* [recorded as *forsteri*], *Tamias l-vit. borealis* and *Zapus*. The Transition element covers the greater part of the hills, and stretches uninterruptedly northward east of the Little Missouri River. It is inhabited by *Lepus campestris*, *Onychomys leucogaster*, *Neotoma rupicola*, *Peromyscus nebrascensis* and *Microtus austerus haydeni*. The Upper Sonoran element finds its northern limit near the Cheyenne River, on the east side of the Hills, but pushes farther north on the west side. It introduces several species (*Geomys lutescens*, *Perognathus paradoxus*, *Perodipus richardsoni*, *Corynorhinus 'townsendi*' and a few others) not occurring elsewhere in the region.

Dr. Allen describes a new cottontail (*Lepus sylvaticus grangeri*) from the higher parts of the Black Hills, and in a previous paper named as new several other mammals collected by Mr. Granger. It is stated that the Gray Pocket Gopher (*Thomomys talpoides*) "is found not only in the prairie country at the base of the Black Hills, but in the small parks in the Black Hills, at an altitude of 5500 ft." Specimens collected in the higher parts of the Black Hills by Mr. Bailey are not the same as those from the surrounding low country.

In all, 53 species are enumerated, with more or less full annotations. The specific name of the Black-tail deer is carried back from *macrotis* Say (1823) to *hemionus* Rafinesque (1817).

The list as a whole is a welcome addition to our local knowledge of the mammals of a small but interesting area.

C. H. M.

SCIENTIFIC JOURNALS.

JOURNAL OF GEOLOGY, AUGUST-SEPTEMBER.

James Dwight Dana and His Work as a Geologist: By H. S. WILLIAMS. Prof. Dana's contributions to the geology of this country are so many and so varied, they are such a fundamental part of our knowledge, that so long as the science endures he cannot be forgotten. Prof. Williams has succeeded in bringing together the salient features of his work in a very satisfactory manner.

Glacial and Interglacial Deposits near Toronto: By A. P. COLEMAN. The question whether there was one or two or more glacial epochs has been so long and earnestly discussed that we hail with pleasure any decisive and positive contributions to the subject. Such is this article by Mr. Coleman. He finds in the cliffs near Toronto three beds of till separated by stratified material. Between the lower and middle till the stratified material is 140 feet of laminated clay and sand, while between the middle and upper till there is seventy to one hundred feet of sand and clay. In the first of these a larger collection of fossils has been found than in any like deposit in the world. Among insects five families, fifteen genera and twenty-nine species are represented. These are all extinct forms and may be considered as indigenous to the locality and not decidedly boreal. Of vegetable remains fifteen species were represented. These, according to Dr. Macoun, indicate a climate like that of the northern part of the Gulf of St. Lawrence or southern Labrador. There was no sign of ice action, but rather of quiet water conditions. In the valley of the Don, a few miles away, apparently in the same relations to the till, many unios were found, a few gasteropods and specimens of the wood of Oak, Ash, Elm, Pawpaw and Osage Orange were found. These point to a climate as warm as that of Toronto at present, if not as warm as Ohio. The unios are such as chiefly now belong to the Mississippi basin and not to the St. Lawrence. In addition to the lapse of time indicated by the deposit of these one hundred and forty feet of fine sediments he finds an erosion interval represented by ninety feet deep and one-half mile wide cut in the deposits after

their emergence and before the succeeding beds were formed. Above these beds is thirty feet of till consisting of a blue calcareous clay with striated erratics of limestone and Utica shale, together with Laurentian boulders. Then follows about one hundred feet of stratified sand and gravel, which has no fossils and shows evidence of the not-distant presence of the ice. The upper till is twenty to thirty feet thick and contains striated erratics of limestone, shale and gneiss. Mr. Coleman seems to make a very strong case for one important interglacial epoch and one subordinate interglacial episode.

Origin of Certain Features of Coal Basins: By H. F. BAIN. A description of the coal basins of Iowa as throwing light on coal horizons in general.

Preglacial Gravels on the Quartzite Range Near Baraboo, Wis.: By R. D. SALISBURY. Certain peculiar gravels are found at high levels in Wisconsin and surrounding States which differ from all glacial gravels. The author discusses the significance of these, suggests a correlation and concludes that the area indicated was submerged much later than had been supposed, possibly as late as the Cretaceous or Tertiary.

Glacial Studies in Greenland: By T. C. CHAMBERLIN. This is one of a series of papers founded on the personal observations of the author during the last summer. They embody some rather unique additions to our knowledge of the formation and work of glaciers.

The Upper Paleozoic Rocks of Central Kansas: By C. S. PROSSER. This is a description and correlation of the rocks of Kansas.

Summary of Current Pre-Cambrian North American Literature: By C. R. VAN HISE. Since the introduction of the microscope into geological study a flood of light has been thrown upon this difficult field—the pre-Cambrian rocks. Many investigators are working and there has come to be an extensive literature. Prof. Van Hise brings together this literature and endeavors to interpret it.

THE AMERICAN GEOLOGIST, OCTOBER.

The Synchronism of the Lake Superior Region with other portions of the North American Continent: By N. H. WINCHELL. The author shows that a close similarity exists between the pre-

Silurian strata of the Lake Superior region and eastern New York (including adjacent areas in Canada and New England). This similarity is expressed in the lithological structural and faunal character of the rocks of the two regions. Strata of the Lower, Middle and Upper Cambrian are recognized in both districts. A plea is made for the use of lithological constants in correlating rocks belonging to the earlier epochs of geological history when similar oceanic and physical conditions spread over vast expanses of the earth's surface.

Brachiocrinus and Herpetocrinus: By F. A. BATHER. The generic terms *Brachiocrinus* and *Myelodactylus* were early applied to so-called arm fragments of crinoids. These seem to have been really stem fragments, and as such were later correctly described as *Herpetocrinus*, which term the author thinks wise to retain in place of the others. A revised diagnosis of *H. nodosarius* is presented.

Description of a New Genus and Five New Species of Fossils from the Devonian and Sub-Carboniferous Rocks of Missouri: By R. R. ROWLEY. The new genus is *Aristocrinus*, and the new species belong to the genera *Allagecrinus*, *Granatocrinus*, *Goniatites*; *Pleurotomaria* and *Murchisonia*.

The Elective System as Adopted in the Michigan Mining School: By M. E. WADSWORTH. The Michigan Mining School has recently adopted an elective system which allows more freedom of choice than that in any other mining or technical school. Two studies only—elementary geology and the elementary principles of mining—are required of all students, but there is in some cases a natural sequence of studies, so that students, in order to pursue advanced work in certain lines, must first complete the earlier work in the sequence.

Rock Hill, Long Island, N. Y.: By JOHN BRYSON. An immense boulder on the summit of Rock Hill is described and figured. This boulder is now about 50 by 20 feet, but the author thinks that it was originally, before being quarried for stone, more than 125 by 20 feet. Several other glacial features of the region are discussed.

The Geological Society and American Association Meetings: By WARREN UPHAM. An ex-

tended and complete account of the recent meetings at Springfield, Mass., is given. Abstracts of all the papers (and discussions) read before the Geological Society and before Section E of the A. A. S. are included.

The International Geological Congress.—A Correction: By ALBERT HEIM. Prof. Heim calls attention to some misstatements concerning himself which appeared in the account of the last meeting of the Congress.

NEW BOOKS.

The Manufacture of Explosives. OSCAR GUTTMANN. 2 Volumes. New York, Macmillan & Co. London, Whittaker & Co. 1895. Pp. xiii+348, xii+444. \$9.00.

Solution and Electrolysis. W. C. D. WHETHAM. Cambridge University Press. New York, Macmillan & Co. 1895. Pp. viii+296. \$1.90.

A Laboratory Manual of Organic Chemistry. DR. LASSAR-COHN. Translated by ALEXANDER SMITH. London and New York, Macmillan & Co. Pp. xix+403. \$2.25.

Bulletins of the U. S. Geological Survey, No. 118. Pp. vi+131. *A Geographic Dictionary of New Jersey*. HENRY GANNETT. No. 119. *A Geological Reconnaissance in Northwest Wyoming*. GEORGE HOMANS ELDRIDGE. Pp. vi+72. No. 120. *The Devonian System of Eastern Pennsylvania and New York*. CHARLES S. PROSSER. Pp. vi+81. No. 121. *A Bibliography of North American Paleontology*. CHARLES ROLLIN KEYES. Pp. vi+251. No. 122. *Results of Primary Triangulation*. HENRY GANNETT. Pp. vi+412. Government Printing Office, Washington, D. C. 1894.

Lakes of North America. ISRAEL C. RUSSELL. Boston and London, Ginn & Co. 1895. Pp. x+125. \$1.65.

Greenhouse and Window Plants. CHARLES COLLINS. London and New York, Macmillan & Co. 1895. Pp. x+160. 40 cts.

The Production of Coal in 1894. EDWARD WHEELER PARKER. From the Sixteenth Annual Report of the Director of the U. S. Geological Survey, Washington, 1895. Pp. 224.